AC-4

AC-4

Sugar Maple Controlled Pollination
Progeny Test

Copy 1

Ohio Agricultural Experiment Station

WOOSTER, OHIO

Sugar Maple Controlled Pollination
Progeny Test

Plantation AC-4

Crosses: April, 1955 by PH, HK
Planted: Nov., 1959
Spacing: c.7' x 10'
Design: complete randomization
Location: Apple Creek State Hospital,
Apple Creek, Ohio

115 trees

N

116

			929
		733	
			769
	925		921
4		925	921
	733	921	921
	738	929	739
	769		927
8	733	921	925
	925	921	
	736	927	738
	733	921	769
12	925	737	921
	733	733	921
	736	930	921
	927	927	926
16		927	922
	921	927	925
	927	921	927
	738	927	733
20	925	922	927
	921		923
	921	925	739
	737	738	737
24	921	733	733
	738		737
	929	921	921
	769	733	924
28		925	927
		930	923
	733	733	770
		737	921
32	733	925	927
	925	769	738
	927		927
	733	921	738
36	927	930	733
	927	921	921
		921	736
	733		921
40		925	733
	921	769	925
	925	924	733
	733	929	921
44	925	925	927
	769		770
		37	43

Key (all parent trees were roadside trees at O.A.R.D.C., across from present Service Building)

Progeny Accession Number	Female Parent Number		Male Parent Number
733	358	x	356
735	356	x	open
736	358	x	358
737	358	x	362
738	358	x	open
739	358	x	unpollinated
769	359	x	356
770	359	x	362
921	359	x	open
922	360	x	unpollinated
923	360	x	356
924	360	x	open
925	362	x	open
926	362	x	unpollinated
927	368	x	open
929	368	x	356
930	360	x	360

116
115 trees
10,500 sq ft
(30 x 350)
= 0.24 acres
= 483 trees/ac
90.2 sq ft/tree

HBK & CRB
4-5-65

2002 Apple Creek - Seed Orchard (con't)

Row# / Tree	9	10	11	12	13	14	15	16
1	B 2.2							
2	M^1 2.85	L' 2.8						
3	J 2.05	H^1 3.55						
4	S 4.3	—						
5	O^1 3.3	—						
6		N^1 2.9						
7	T	—						
8	U' 2.5	T 2.45						
9	K^1 3.3	J' 2.65						
10	Q 2.1	—						
11	G^1 1.45	F^1 2.4						
12	M^2 2.45	L^2 2.25						
13	K2 3.4	J^2 2.45						
14	G^2 3.8	H^2 3.0						
15	U2 3.0	—						
16	—	B 2.3						
17	O2 2.8	N2 3.7						
18	L^1 2.8	M 1.85						
19	H 2.75	J^3 2.8						
20	—	K 2.85	T 2.1					
21			—		N 2.45			
22		F2 2.35	Q 2.55	O1.95	M 2.3			
23	L^2 2.9 3.1		G 3.2	U 1.75	L 2.6			
24			J 1.25	H 2.8	K 2.45			
25		Q 2.6	D 1.9					
27				T 2.95				
28					U 2.55			
	1/17	3/16	1/5	0/..	0/..			

AC-4

	%
733 (1)	3.2
(2)	2.5
(3)	4.0
(4)	3.3
(5)	3.0
(6)	2.2
(7)	2.9
929	2.8
(8)	3.25
(9)	10.0
927	3.3

AC-5?

Row D	C	B	A
335-5.5	332-3.0	323-2.6	335-3.05
323-3.25	323-3.75	324-2.65	330-2.6
			323-3.7

AC 5
4 323 · 3 Sample 2
1 324 - 1
1 330 - 1
1 332 - 3
2 335 - 2 sample 2
10 remain

AC-4
733 - 9
969 - 2
770 - 1
922 - 1
927 - 1
929 - 2

Sample 2 where possible

→ to Milbourne

10% 2002

map according to point on street

AC-5 (here)
AC-4 (here)

F F
A
R E
B E
A
~~B~~ L E N G
T S M Q J U O S H
D N K L T J
O H M D Q G U K

35 samples

1 2 3
1 733
2 733
769
3 733
4 733
922
5 733
6 733
929
769
7 733
8 733
770
927
9 733
1 733
929

A ||
B ||
D ||
E ||
F ||
G ||
H ||
J ||
K ||
L ||
M ||
N ||
O ||
Q ||
R |
S ||
T ||

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AC- 4 SUGAR MAPLE CONTROLLED POLLINATION
PROGENY TEST

	Row	Column	Accession No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25 ~~24~~
17, 19, 20, 21	1	1																										
	1	2																										
	1	3	925		22					30		52	260	16	20		13	23		21	4	31	31	28	335	2.35		
	1	4																										
	1	5	733			19			46	20		85	283	15	16	19	11	32	31	25	3	33	31	32	330	2.54		
	1	6	738						42	13	44	99	330	12	14		17	20	29	33	3	39	37	38	338	2.82	40	36
	1	7	769		28				44	14		86	287	22	20		20	30	27	13	5	32	29	17	296	2.47		
3.6	1	8	733		28				46	31		105	350	23	28	22	18	34	35	24	4	41	38	33	401	3.08	35	37
	1	9	925				08			21	29	58	193	12	17		12	33		22	4	22	24	31	231	2.10		
	1	10	736				13			28		41	205	18	22	31	27	25	23	25	4	31	22	23	288	2.40		
	1	11	733												19			27			5	33	23	30	132	×	33	
	1	12	925			09	11		33	21		74	185	19	23	22	13	34	29	30	4	33	25	34	336	2.40		
4.1	1	13	733						50	49		99	495	16	36	35	27	45	39	35	5	61	28	30	451	3.76	58	47
	1	14	736		22	15	20		46	19	34	156	260	19	18	20	14	31	27	26	4	24	28	30	393	2.46		
	1	15	927		23	05	18		30	20		96	192	25	31	23	18	26	19	26	4	22	20	34	340	2.27		
	1	16																										
	1	17	921		16	12	13	22	31	21		115	192	11	21	36	20	24	20	26	5	24	14	29	340	2.12		
	1	18	927		18	14			23	23		78	195	17	19	30	18	24	28	30	4	22	30	44	340	2.43		
	1	19	738							30		30	300	19	14		24	23			3	13	21	50	194	2.42		
	1	20	925						20	20		40	200	15	19	17	12	24	16	25	4	21	22	21	232	1.93		
	1	21	921			12	18		44	27		101	252	20	18	26	15	31	28	34	5	22	33	34	362	2.58		
	1	22	921						26	12		38	190	15	19	16		34	33	32	4	25	23	28	263	2.39		
	1	23	737															14			5					×		
	1	24	921							10		10	100	13	18		16	29	21		5	27	26	27	187	2.07		
	1	25	738		40	17	21		63	32		173	346	21	26	31	17	26	29	31	3	14	30	32	430	2.87	45	
3.2	1	26	929		36	29	20		29	22		136	272	20	23	16	17	32	44	35	5		24	42	389	2.78	55	37
	1	27	769		40		19		40	21	46	166	332	17	19		23	33	38	33	4	34	30	34	427	3.05	34	NR
	1	28																										
	1	29																										
3.7	1	30	733				05		40	22	40	107	268	21	11	21	18	32	34	31	4	35	33	48	391	2.79	40	37
	1	31																										
	1	32	733						22			22	220	12	13		13	28			4	32	29	43	192	2.40		
	1	33	925				12		36	21		69	230	19	20	17	17	25	24	25	4	25	21	27	289	2.22		
	1	34	927	33			20	35	34	23		145	240								5	30	29	28	232	2.90	31	
	1	35	733											19	20					14	4		26	46	125	×	38	
3.8	1	36	927				21		29	23		73	243	18	16		22	33	33	33	4	35	31	60	354	2.95	38	NR
	1	37	927				18		28	24		70	233	18	16		25	31	37	25	5	34	22	36	314	2.62		
	1	38																										
	1	39	733						19	25		44	220	15	11			25		21	4	36	28	36	216	2.40		

AC- 4 SUGAR MAPLE CONTROLLED POLLINATION

PROGENY TEST

Row	Column	Accession No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25 24
1	40																										
1	41	921			23	13		27	29		92	230	22	19	18	17	28	22	35	4	31	29	35	348	2.48		
1	42	925				12			21		33	165	17	08		15	24	27	19	5	29	17	29	218	1.98		
3.4 1	43	733		20	13	13		48	32		126	252	20	15		23	30	30	25	4	43	29	24	365	2.60	45 NR	
1	44	925							21		21	210							23	4		21	24	89			
1	45	769			07	09		36	28		80	260	19		26	14	30	28		4		34	30	261	2.37		
2	45																										
2	44	925						23	13	24	60	200	18	20		08	32		23	4	25	28	28	242	2.20		
2	43	929				20		47	35	67	169	422	28	22	21	23	25	36	32	3	42	22	41	461	3.29	33	39
2	42	924	34		17	15	45	44	22		177	295	26	24	28		34	29	35	4	39	31	30	453	3.02	32	
2	41	769	27	13	10	07		42	28		127	212	21	19	18	17	34	32	33	5	30	24	31	386	2.41		
2	40	925	24	10	09	08		30	24	27	132	188	19	18	18	15	24	25	22	3	22	19	28	342	2.01		
2	39																										
2	38	921							16	41	57	285	13	16		13	27			5	29	31	35	221	2.46		
2	37	921						34	17		51	255	22	20	21		27	26	29	4	26	23	32	277	2.52		
2	36	930						16	10	37	63	210	13	12			17		15	4	21	10	—	151	1.68		
2	35	921					17	43	16		76	253	25	26			27	30	27	5	32	35	33	311	2.83	38	
2	34																										
2	33	769					21	38	21		80	267	20	16	14		33	29	22	4	39	29	30	312	2.60		
2	32	925					32	18	09		59	197	21	20	21		33	20	23	4	33	30	41	301	2.51		
2	31	737						37	08	40	85	283	15	10	21		26	30		3	29	25	27	268	2.44		
2	30	733					31	64	44		139	463	17	17			36	36	50	4	34	33	38	400	3.64	41	42
2	29	930												09			18		13	5				40			
2	28	925		21	20	16	20	35	18		130	217	20	25	21		25	24	24	5	20	25	31	345	2.30		
2	27	733			27			40	23		90	300	19	20			32	29	36	4	25	29	27	307	2.79	38	
2	26	921					27	28	27	36	118	295	23	20	22	17	24	27	27	5	25	25	28	356	2.54		
2	25																										
2	24	733					38	41	28	54	161	402	21	20			33	35	36	3	30	31	33	400	3.33	33 NR	
2	23	738			12		23	36	25		96	240	18	18		16	33	35	25	4	25	22	29	317	2.44		
2	22	925				09	20	21	16		66	165	20	19	20		18	19	20	4	23	22	20	247	1.90		
2	21																										
2	20	922				14	35	40	23	51	163	326	20	24			36	37	35	4	28	30	21	394	3.03	34 NR	
2	19	927			10						10	100	12											22			
2	18	921			11	07	37	28	31		114	228	19	19			26	23	25	5	32	22	30	310	2.38		
2	17	927						26	12		38	190	19	18			27	21	25	3	13	25	32	218	2.18		
2	16	927							15	31	46	230	11	21	13		33	32	24	5	36	28	40	284	2.58		
2	15	927							32		32	320	20	23			28	33	35	4	44	22	38	275	3.06	33	
2	14	930					36	46	20		102	340	17	23			27	31	22	3	25	21	40	308	2.80	25	

AC- 4 SUGAR MAPLE CONTROLLED POLLINATION
PROGENY TEST

See Table 1

Row	Column	Accession No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
2	13	733						38	12		50	250	19	20	22	18	23	29	24	4	25	24	25	279	✓ 2.32		
2	12	737			18	10		34	10		72	180	17	14		18	22		14	4	20	24	19	220	✓ 1.83		
2	11	921	23					39	24		86	287	17	19	29		38	41	25	5	38	19	27	339	2.82	31	
2	10	927			16	14					30	150	-	-	-	-								30	✓ X		
2	9	921							23		23	230	18	18	18		28	28	34	4	31	25	29	252	✓ 2.52		
2	8	921																									
2	7																										
2	6	929						25	17	28	70	233	17	15	15	11	21	18	16	3	19	24	31	257	✓ 1.98		
2	5	921			14	17					31	155	14	21	25	11	37	27	16	4	32	31	24	269	✓ 2.24		
2	4	925						34	17	33	84	280	20	28	24	16	32	30	35	5	26	22	29	346	2.66	24	
2	3																										
2	2																										
3.4 ✓ 2	1	733											18	13		14	36		31	4	40	24	40	216	X 2.70	50	37
3	1																										
3	2	769					42		27	54	123	410	25	23	28		29		36	4	24	29	32	349	3.17	44	
3	3	921					25		29		54	270	21	23	28		25		29	3	31	31	36	278	2.78	40	
3	4	921															34		22	5	28	20	31	135	X		
3	5	921		16		12	28		26	26	108	216	20	16		15	29		24	4	27	22	38	299	✓ 2.30		
3	6	739		32	21	18					71	237	30	30	31		35		38	5	30	18	24	307	2.79	37	
3	7	927			09																				X		
3	8	925			16								18		17		20		30	4	27	23	30	165	✓ 2.06		
3	9																										
3	10	738			17	23			24		64	213	20	16	26	14	29		30	3	30	34	40	303	✓ 2.52		
3.7 ✓ 3	11	769						32	29	57	118	393	22	23	29	21	44	39	39	4	40	35	41	451	3.47	29	39
3	12	921												09						5	25	20	33	87	X		
3	13	921						26			26	260	21	16			26			5	30	21	34	174	✓ 2.48		
3	14	921					40	38	14	47	139	348	22	21	26	20	29		28	5	28	31	32	376	2.89	38	
3	15	926						30	25	37	92	307	12	16	20	07	32		24	4	28	26	24	281	✓ 2.34		
3	16	922																									
3	17	925		22	14	06		28	25		95	190	18	16	19	18	22		18	4	25	24	27	282	✓ 2.01		
3	18	927						20	22		42	210	19	17	23		33	30	27	4	34	29	29	283	✓ 2.57		
4.0 ✓ 3	19	733			12	38		51	27		128	320	25	25	37		31	30	36	3	42		29	383	3.19	46	39
3	20	927				36	20	28	22	44	150	375	26	19	24		18	21	24	3	29	32	36	379	2.71	49	
3	21	923																									
3	22	739						29	17		46	230	17	13			23			4	35	25	41	200	✓ 2.50		?
3	23	737						48	27		75	375	18	17	26		26	35	28	3	33	22	33	313	2.84	37	37
4.0 ✓ 3	24	733				18		48	26		92	307	20	22	30		25	29	25	4	41	26	58	368	3.07	41	37
3	25	737			19	18		34	21		92	230	19	20	22		24		25	4	28	25	33	288	✓ 2.40		

AC- 4 SUGAR MAPLE CONTROLLED POLLINATION PROGENY TEST

✓ = Add
— = Divide

Row	Column	Accession No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
3	26	921						50	36	59	145	483	28	19	26		20	30	27	4	46		—	~~341~~	~~3.41~~		
3	27	924						47	25		72	360		14			38	17	21	4	32	31	27	252	2.80	30	
3	28	927			10			27	14		51	170	18	15	23	13	30		17	4	26	28	35	256	2.13		
3	29	923			16			18	12		46	153		09	09				13	5	19	16	19	131	1.46		
3	30	770	27		22		41	39	23	34	186	310	21	15	19	15	25	29	29	4	34	42	39	454	2.84	57	37
3	31	921																									
3	32	927			19		29	22	25	39	134	268	14	19	24		21	18	25	5	20	23	30	328	2.34		
3	33	738					19	34	25	32	110	275	20	16	21	09	31	32	32	4	34	24	33	362	2.59		
3	34	927						27	19	30	76	253	15	13		09	29	19	32	4	33	26	40	292	2.43		
3	35	738			23		31	46	25	37	162	324	17	15	23	13	23	30	25	4	34	41	26	409	2.73	40	
3.3 3	36	733						28	21	30	79	263	18	16			37	37	21	4	44	27	46	325	2.95	41	36
3	37	921	20		15	10	23	37	21	37	163	233	20	18	18		19	26	25	4	26	25	30	370	2.31		
3	38	736						21	17		38	190	16	14		08	24		12	4	30	22	26	190	1.90		
3	39	921			16	17		38	24	32	127	254	19	16	20	14	32	37	34	4	43	30	41	413	2.75	32	
3.9 3	40	733			09	12		40	26		87	218	20	14	22		24	37	33	4	35	33	53	358	2.75	41	38
3	41	925			17	09		29	19		74	185	20	17	25		25	32	25	3	27	24	34	303	2.33		
3	42	733	25		17	08		39	25		114	228	25	36	27	18	18		26	4	57	38	43	402	2.87	36	
3	43	921	36	20	16	11		32	14	42	171	244	17	18	21		26	31	31	4	30	30	35	410	2.56		
3	44	927	18		12	07	22	26	14	41	140	200	16	13	14	10	16	24	26	4	29	23	33	344	2.02		
3	45	770	18	29	11			29	16	29	126	210	15	12	16	15	06		25	5	23	34	30	302	2.01		
		Σ						2920		1369		26540					2890				3129	2783	3455			1542	538
		n						84		35		103					104				103	105	105			40	14
		$\bar{y}$						3.48		3.91		2.58					2.78				3.04	2.65	3.29			3.86	3.84
		σ_n										±.74															
Trees remaining in 1987		Σ						754		483							611				698	553	748				
		n						19		9							19				18	18	19				
		$\bar{y}$						3.97		4.70							3.22				3.88	3.07	3.94				

10:30

19 trees total

1965

110

1969 1973 1977

1979 1984

Σ 1438

n 40

$\bar{y}$ 3.60

σ_{n-1} ±0.89

1 a

~~Only Column 28 figures are valid~~ (not X, 26, 27, Y or red)

not in the 7-date tally		Don't use (original) X	26	27	Y	(Proc. 5th World For. Cong.) revised X	Columns 6, 19, 21 (Y) 28	29	30	Col's 6,17, 19,20,21	6,17, 19
R	C										
1	5 733	3.53		7	3.29	3.60	3.70				35
	6 738 R1 C6	3.26	24	31	3.40	3.35 ~~3.05~~	3.97 ✓	28	26		38
	7 769	3.04		7	2.74	3.15	3.10				30
	8 733 R1 C8	3.53	32 ✓	47 ✓	3.59	3.60	4.10 ✓	35	23	3.6	37
	9										
	10										
	11		32								
	12 925	2.74		7	3.11	2.82	3.33				32
	13 733 R1 C13	3.53	38	56	4.11	3.60	4.70 ✓	35	35	4.1	49
	14 726	[illegible]		7	[illegible]	3.	[illegible]				
1	15 927	2.72		7	2.53	2.92	2.87				26
	16										
	17 921	2.76		7	2.40	3.02	2.80				27
	18 927	2.72		7	2.87	2.92	2.97				25
	19										
1	20 925	2.74		7	2.13	2.82	2.07				
	21 921	2.76		7	3.23	3.02	3.33				
	22 921	2.76		7	2.87	3.02	2.63				
	23										
	24										
1	25 738	3.26	24		3.21	3.35 ~~3.05~~	3.63 ✓				
	26 R1 C26		24	38				36	26	3.2	
	27 769 R1 C27	3.04	28	37	3.46	3.15	3.60 ✓	35	22		
	28										
	29										
1	30 733 R1 C30	3.53	28	48	3.61	3.60	4.10 ✓	34	23	3.5	
	31										
	32 733	3.53			3	3.60	3.23				
	33 925	2.74			2.61	2.82	2.93				
	34 927	2.72	24			2.92	3.07 ✓				
1	35		27								
	36 927 R1 C36	2.72	30	44	3.63	2.92	4.13 ✓	34	30		
	37 927	2.72		7	3.04	2.92	3.27				
	38										
1	39 733	3.53				3.60	3.03				

R C

R C				26	27		28		29	30	
41	921		2.76			3,02	3.10				
42											
43	733	R1 C43	3.53	29	42	3,60	3.83	✓	31	23	3.4
44											
1 45											
44	925		2.74			2,82	2.53				
43	929	R2 C43	3.00	34	44	3,05	4.33	✓	41	31	
42	924		2.69	28		2,88	3,77	✓			
41	769		3.04			3,15	3,40				
2 40	925		2.74			2,82	2.67				
37	921		2.76			3,02	3.07				
35	921		2.76			3,02	3.60	✓			
33	769		3.04			3,15	3.57				
32	925		2.74			2,82	3,07				
31	737		3.11			3.25	3,10				
2 30	733	R2 C30	3.53	32	34	3,60	4.53	✓	32	28	
28	925		2.74			2.82	2.87				
27	733		3.53	32		3.60	3.07	✓			
26	921		2.76			3,02	2.70				
24	733	R2 C24	3.53	27	27	3.60	3.47	✓	25	18	
23	738		3,47			~~3,05~~ 3,35	3.00				
22	925		2.74			2,82	2.13				
20	922	R2 C20	self	30	25	2,70	2.97	✓	31	19	
18	921		2.76			3,02	3.00				
17	927		2.72			2.92	2.37				
				39							
14	930		self	31		2.70	3.70	✓	44		

3a

				26	27		28		29	30	
13	733		3.53			3.60	2.93				
~~12~~	737		3.11			3.25	2.43				
11	921		2.76			3.02	3.47	✓			
6	929		3.00			3.05	2.50				
4	925		2.74	23		2.82	2.97	✓			
		R2 C1		32	43				~~34~~	28	3.4
				24							
				37							
				19							
3 11	769	R3 C11	3.04	37	47	3.15	3.77	✓	45	26	
~~13~~	921		2.76			3.02	3.00				
~~14~~	921		2.76	27		3.02	3.27	✓			
							~~2.73~~				
~~17~~	925		2.74			2.82	2.67				
18	927		2.72	7		2.92	2.77				
19	733	R3 C19	3.53	38	41	3.60	4.07	✓	41	30	4.0
20	927		2.72	22		2.92	3.10	✓			
							~~3.50~~				
23	737		3.11	25		3.25	3.80	✓			
24	733	R3 C24	3.53	28	35	3.60	4.90	✓	38	23	
25	737		3.11			3.25	3.17				

4a

Don't use; use revised x values

			26	27		28	29	30
27	924	2.69			2.88	3.35 ✓		
~~28~~	927	2.72			2.92	2.93		
~~29~~	923	2.96			3.00	1.87		
30	770	R3 C30 2.62	30	40	2.80	3.73 ✓	32	25
32	927	2.72			2.92	2.40		
33	738	3.26			3.35 ~~3.65~~	3.37		
34	927	2.72			2.92	3.33		
35	738	3.26			3.35 ~~3.65~~	3.53 ✓		
36	733	R3 C36 3.53	43	54	3.60	3.93 ✓	36	45
37	921	2.76			3.02	3.10		
38	736					2.57		
39	921	2.76	34		3.02	4.07 ✓		
40	733	R3 C40 3.53	32	37	3.60	4.27 ✓	37	25
41	925	2.74			2.82	3.00		
~~42~~	733	3.53			3.60	4.63 ✓		
43	921	2.76			3.02	3.23		
44	927	2.72			2.92	2.93		
~~45~~	770	2.62			2.80	2.73		

76

	Col 26	Col
Σ	1021	770
n	34	19
$\bar{y}$	3.00	4.05

3.3

74

(Don't use; based on incomplete x values)

Column 27:
(Ind. tree basis)

n = 58

r = 0.3124395

Slope = 0.2898

Intercept = 2.195

b = 0.290

h^2 = 0.290

$y\ \sigma_{n-1}$ = 0.47186

$y\ \sigma_n$ = 0.46778

Mean of col's 6, 15, 16, 17, 19, 20, 21

(not as sure of accuracy as for col. 28

Don't use (Based on incomplete x values)

Column 28:
(Individual tree basis)

n = 74

r = 0.5424713

a = Intercept = 0.2111599

b = Slope = 1.0257373

For x = 3.0
Y = 3.2883719

For x = 2.0
Y = 2.2626346

For x = 4.0
Y = 4.3141093

y mean = 3.28

$y\ \sigma_n$ = 0.6169

$p < 0.001$

σ_n = 0.6222412

Mean = 3.2832432

a = 1.026

b = 0.211

y = a + bx

h^2 = 0.211

y = 0.211 + (1.026) x

y = mean of col's 6, 19, 21

GRAPH 2B

Column 28 (revised, using different x values)

n = 76

r = 0.5463310

2nd b/a = 1.1658 9748

x y = 0.5139027

y. Mean = 3.28

y mean 3.1026

3.284 ± 0.6169
+ 0.2825

X Σ Y = -0.416404

1.1928616

X Σ Y = 0.2825419

σ_n = 0.6169032

x = 2.5, y = 2.566

x = 3.0, y = 3.162

x = 3.759 4, 4.355

Y = mean of col's 6, 19, 21

CHRONOLOGICAL NOTES AC-4

1. Sugar tests - 3-20-62 (% x 10)
2. Sugar tests - 3-26-62 (% x 10)
3. Sugar tests - 3-27-62 (% x 10)
4. Sugar tests - 3-28-62 (% x 10)
5. Sugar tests - 12-18-63 (% x 10)
6. Sugar tests - 3-16-64 (% x 10) age 8 (from seed)
7. Sugar tests - 3-23-64 (% x 10)
8. Sugar tests - 3- 1-65 (% x 10) age 9
9. Sum of percentage contents of sugar (times 10) for sap collections from 3-20-62 to 3-1-65.
10. Mean (times 100) for percentage contents of sugar for sap collections from 3-20-62 to 3-1-65.
11. Sugar tests - 3-28-65 (tests close to the ground) (% x 10)
12. Sugar tests - 3-31-65 (low) (% x 10)
13. Sugar tests - 3-31-65 (high) (% x 10)
14. Sugar tests - 4- 5-66 (% x 10)
15. Sugar tests - 3-1&2-66 (% x 10)
16. Sugar tests - 3- 4-66 (% x 10)
17. Sugar tests - 3-10-66 (% x 10) Age 10
18. Stage of leafing out 4/26/68 1= dormant, 6= full leaf
19. Sugar tests - 3-5-69 (% x 10) age 13
20. Sugar tests - 3-1-73 (% x 10) age 17

CHRONOLOGICAL NOTES AC-4 (0+2)

21. Sugar tests - 3-8-77 (% x 10) Age 21

22. Sum of columns 9-17 & 19-21 (except 10)

23. Mean of columns 9-17 & 19-21 (except 10)

24. Sugar tests 3-8-79 (% x 10), on all trees remaining after 1977 thinning Age 23

25. Sugar tests- 3/15/84 (% x 10), on all trees remaining after 1977 and 1979 thinnings and any subsequent mortality. Age 28

26. Sugar tests - 3/9/86 (% x 10) - see also separate sheet Age 30

27. Sugar tests - 3/6/87 (% x 10) - see also separate sheet Age 31

28. Sugar tests - Mean of columns 6, 19, 21 (3/16/64, 3/5/69, 3/8/77)

29. Sugar tests - ~~3/29/88~~ (% x 10) - see also map

30. Sugar tests - 3/10/88 (% x 10) - see also map Age 32

(o+2)

OPERATIONS LOG AC-4

1. Pollinations made April, 19~~0~~55
2. Planted November, 1959
3. Fertilized Spring, 1961
4. Fertilized May, 1962
5. Fertilized Spring, 1964
6. Pruned December, 1965
7. Fertilized Spring, 1967
8. Pruned November, 1967
9. Fertilized (Ammonium nitrate) 3/4/68
10. Sprayed (2 lbs atrazine + 2 lbs simazine/A) 6/28/68
11. Pruned November, 1968
12. Thinned Mar. 14-18, 1977, removing all trees averaging 2.60 and under in col. 23 (Except Rl, C 43) — T_1 — to 167 trees/acre
13. Thinned winter 1985-86 (after Mar 1986 measurements) — to 79 trees/acre

T_1	Mar 1977	age 21
T_2	Mar. 1979	age 23
T_3	Mar 1986	age 30
T_4	?	

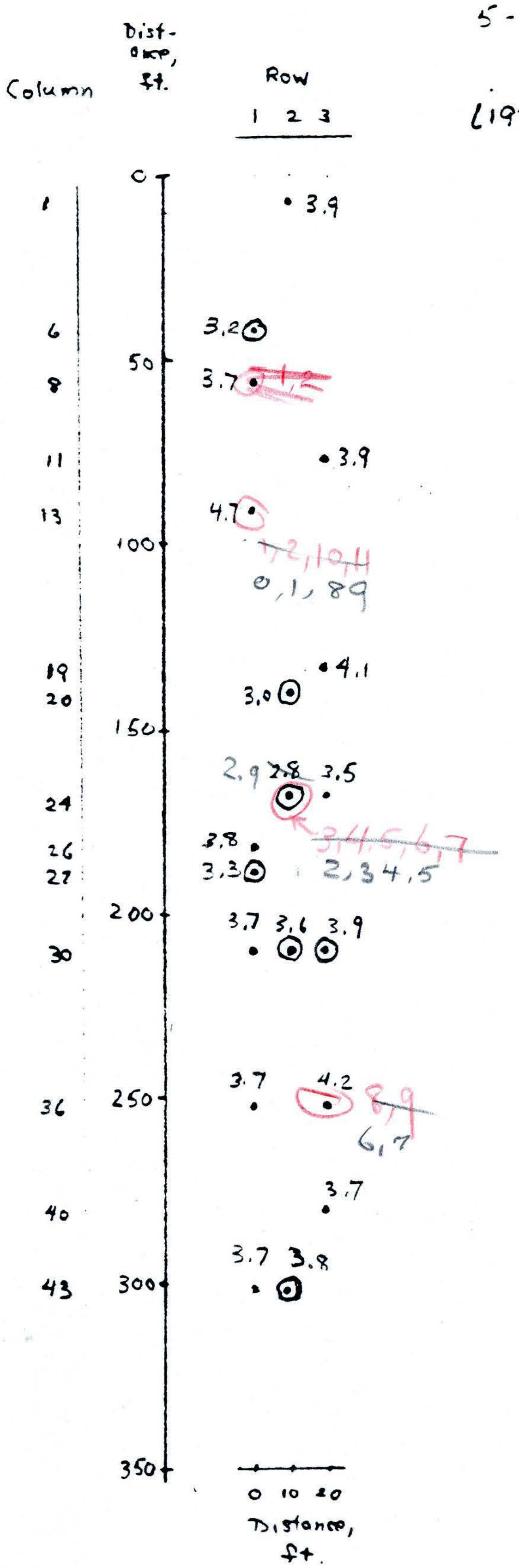
SUMMARY "Table 1"

AC-4
POST-ROGUING MAP

(As of March 1987)

5-yr $\bar{y}$ (1979-88)

Scale: 1" = 50'

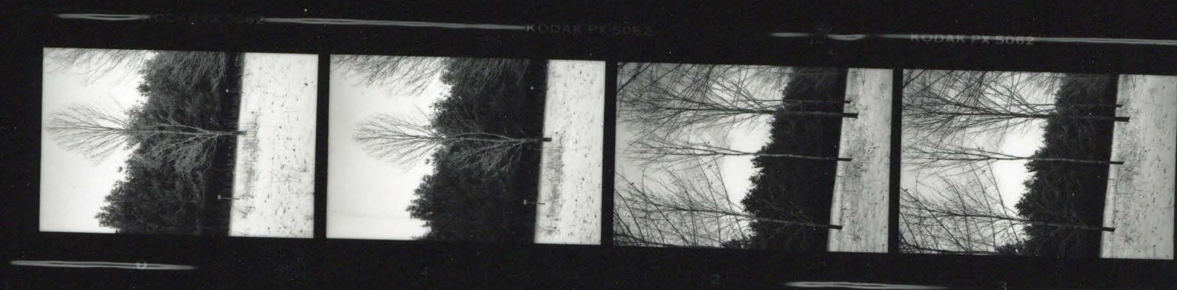


O = Marked for roguing 3 Mar. 88

Photographs (Plus-X) 15 March 88

Family 733

See also AC-1 for photos



* photo plastic products Inc.

P. O. BOX 17638, ORLANDO, FLORIDA 32860

(3/11/88)

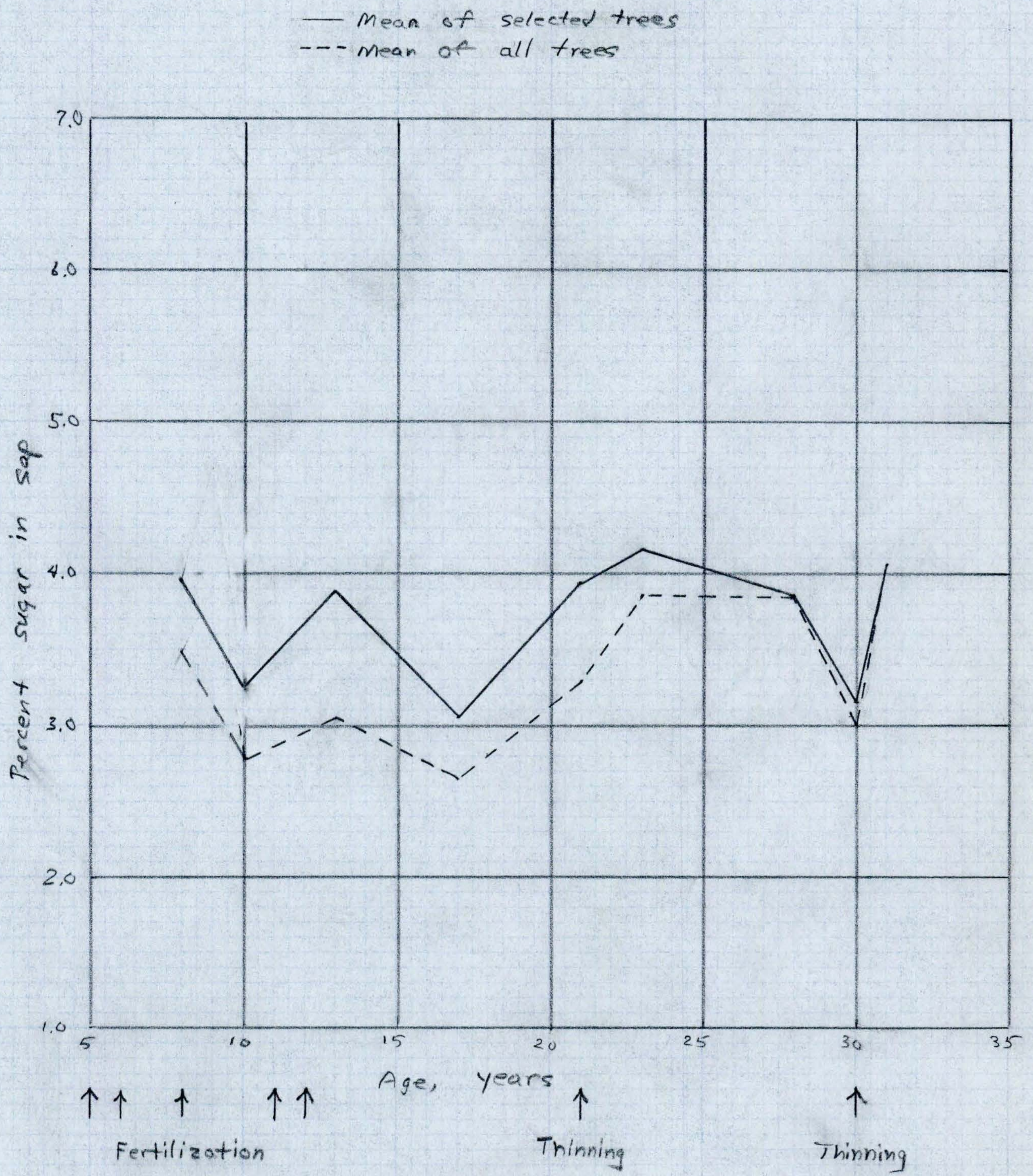
AC-4
Family 733
% sugar

		Age 8	Age 10	Age 13	Age 17	Age 21	Age 23	Age 28	Age 30	Age 31		Age 32
		Col. 6	Col. 15	Col. 19	Col. 20	Col. 21	Col. 24	Col. 25	Col. 26	Col. 27	Col. 29	Col. $\frac{29+30}{2}$
		1964	1966	1969	1973	1977	1979	1984	1986	1987	1988	1988
733 AC-4	n	12	14	14	14	14	15	13	14	11	11	11
	$\bar{x}$	4.458	3.142	4.007	2.986	3.914	4.107	4.185	3.214	4.218	~~3.436~~	3.082
	σ_{n-1}	0.882	0.660	0.969	0.470	1.029	0.665	0.787	0.467	0.875	~~0.415~~	0.483
		1964				1977	1978	1982	1984	1986	1987	1988
733 AC-1		9				3	8	8	9	9	8	8
	$\bar{x}$	5.4				3.6	4.4	4.6	4.5	3.9	4.4	3.5
AC-1		1.501				0.404	0.716	1.031	1.285	1.288	1.391	1.100

			(except 1964)	
AC-4	9 yrs	$n =$	9	10
		$\bar{x} =$	3.648	3.731
		$\sigma_{n-1} =$	0.530	0.559
AC-1	7 yrs	$n =$	7	
		$\bar{x} =$	4.271	
		$\sigma_{n-1} =$	0.663	

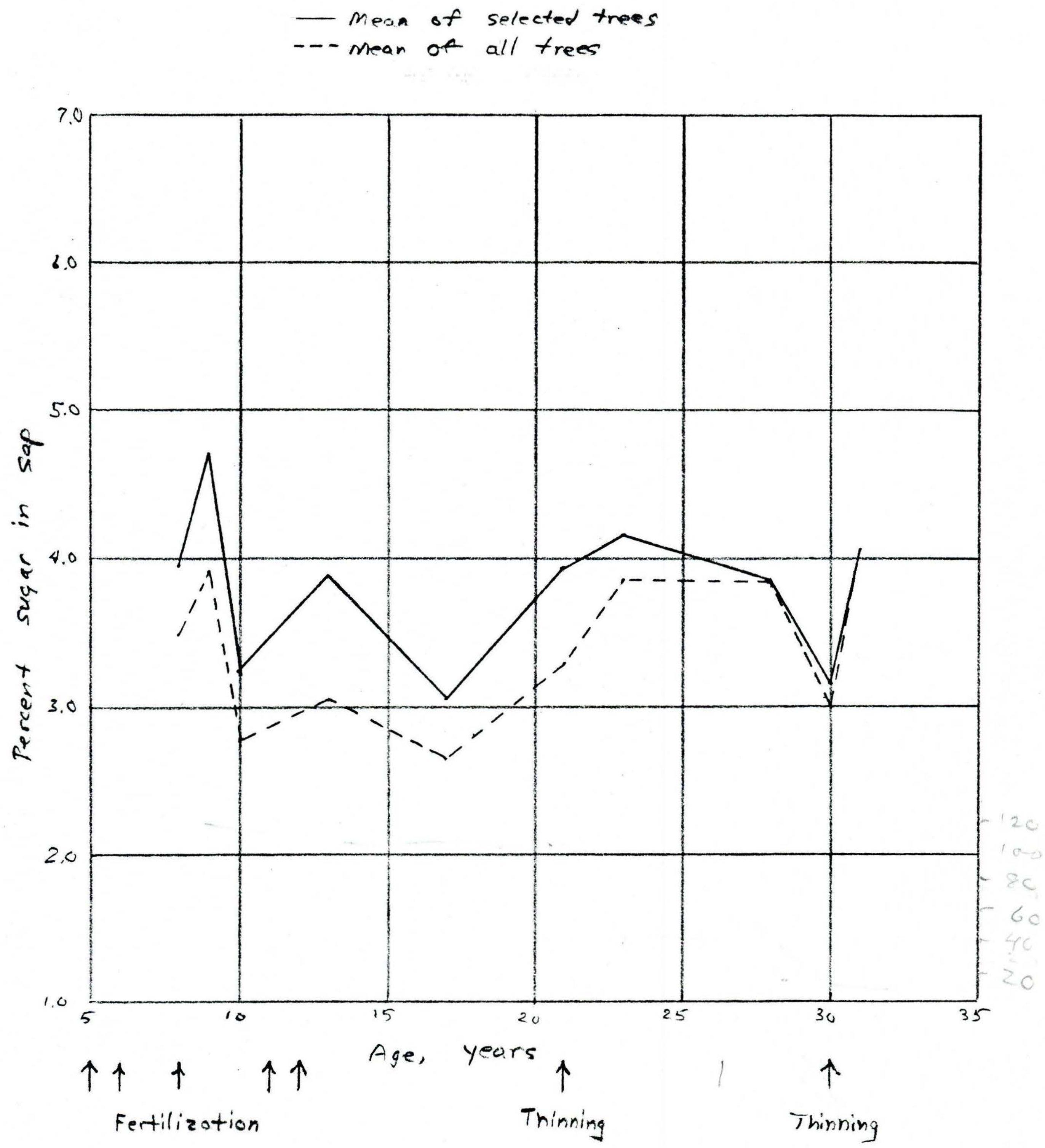
AC-4

MEAN PERFORMANCE OF THE 19 SELECTED TREES COMPARED WITH THE MEAN PERFORMANCE OF ALL TREES



AC-4

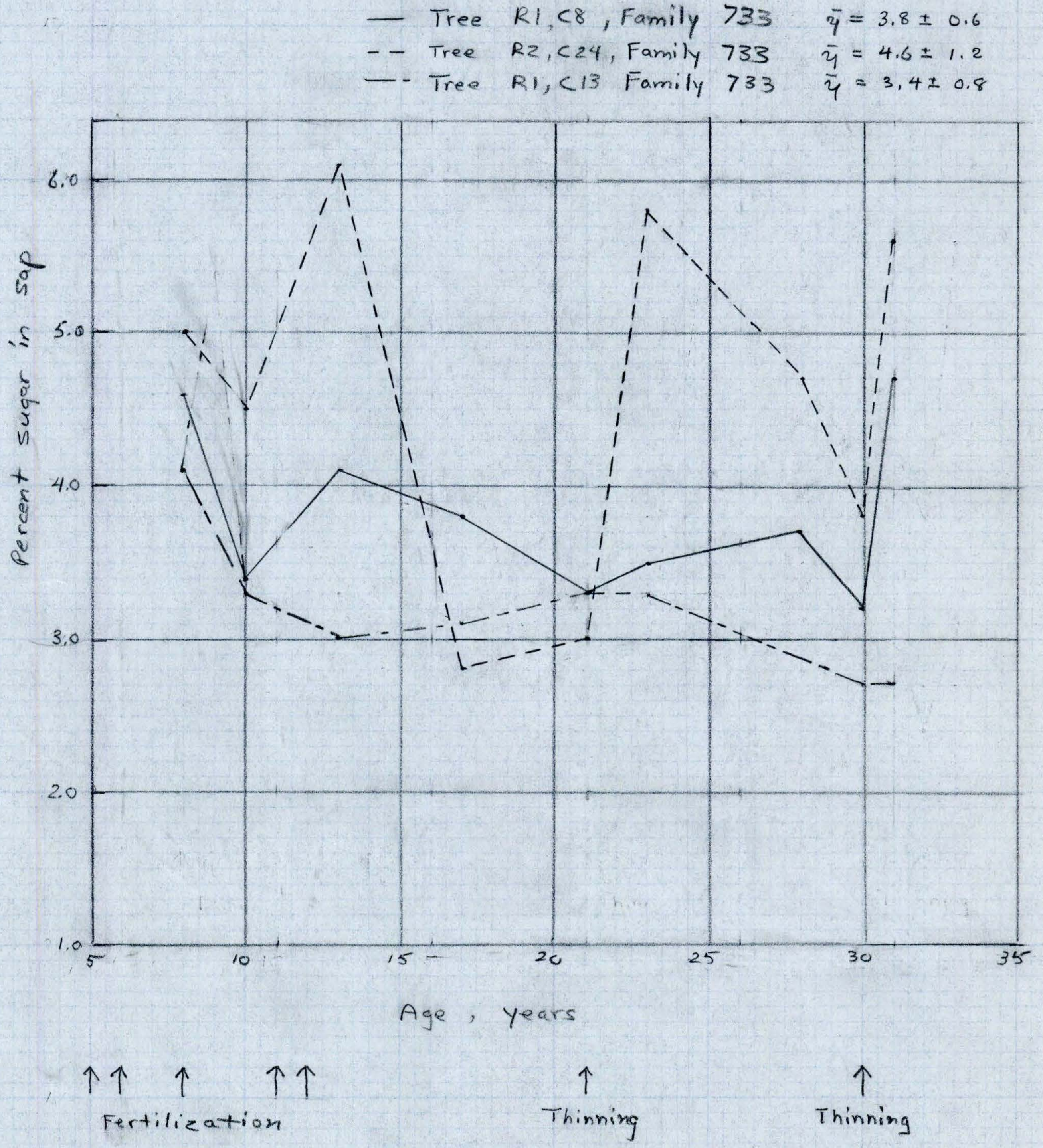
MEAN PERFORMANCE OF THE 19 SELECTED TREES COMPARED WITH THE MEAN PERFORMANCE OF ALL TREES



AC-4

INDIVIDUAL TREE PERFORMANCE

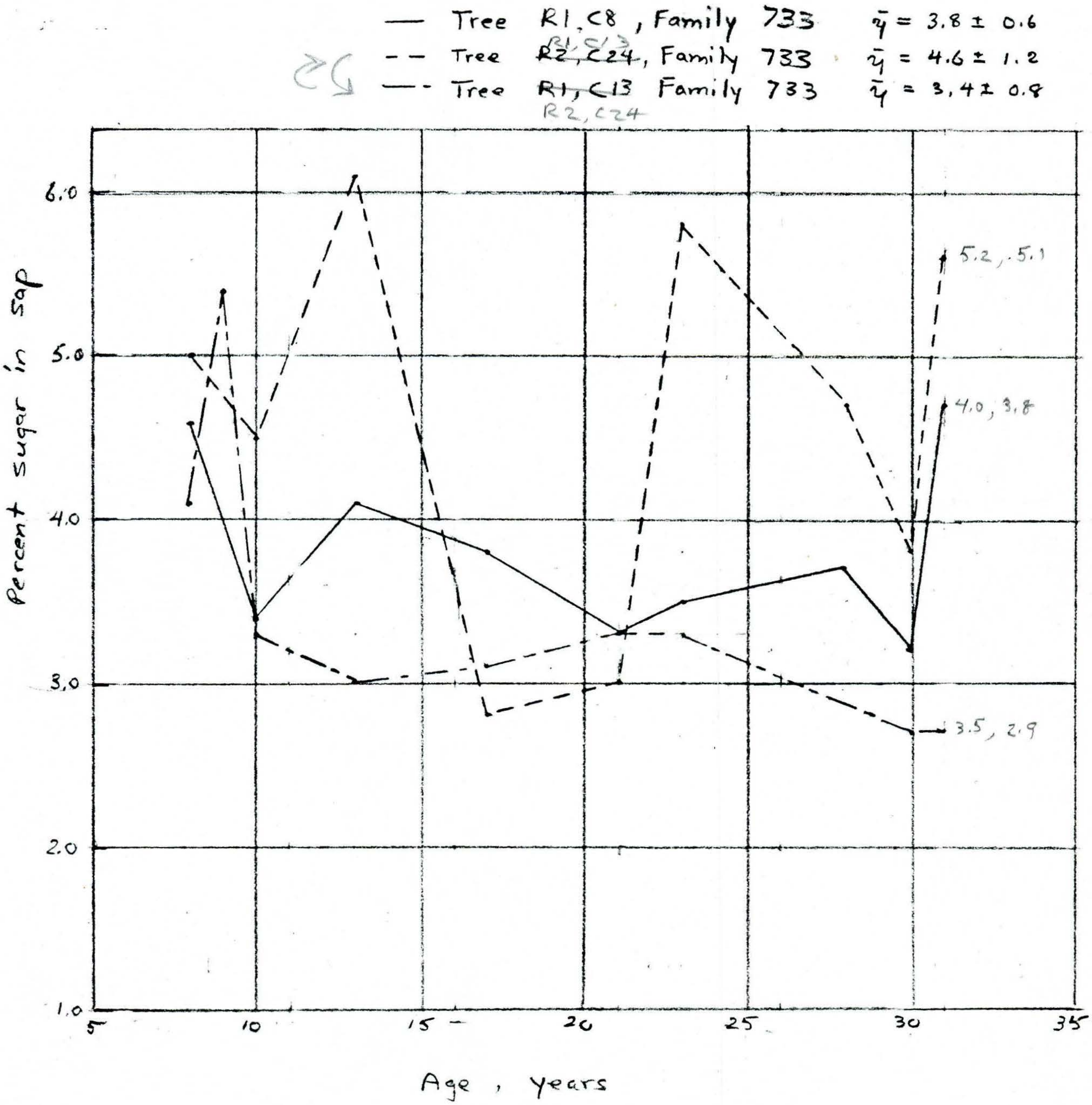
3 Selected Trees of 1 Family



AC-4

INDIVIDUAL TREE PERFORMANCE

3 Selected Trees of 1 Family



Fertilization

Thinning

Thinning

AC-4 Plotted points

No. of trees	Yr	age (March)	Column	Tree R1, C8	Tree R1, C13	Tree R2, C24
	64	8	6	4.6	5.0	4.1
116	65	9	8	–	–	5.4
	66	10	15	3.4	4.5	3.3
105	69	13	19	4.1	6.1	3.0
				4.03	5.20	3.47
105	73	17	20	3.8	2.8	3.1
105	77	21	21	3.3	3.0	3.3
40	79	23	24	3.5	5.8	3.3
40	84	28	25	3.7	4.7	–
19	86	30	26	3.2	3.8	2.7
19	87	31	27	4.7	5.6	2.7
				3.80	5.07	2.90
			$\bar{y}$ =	3.81	4.59	3.43
			σ_{n-1} =	0.55	1.19	0.85

Note: this mean is not based on measurement of all reps.

Yr	age	Column	All trees (see records, p. 4)	Selected trees	n	Difference (selected – all trees)
64	8	6	3.48	3.97	19	0.49
65	9	8	3.91	4.70	9	0.79
66	10	15	2.78	3.22	19	0.44
69	13	19	3.04	3.88	18	0.84
73	17	20	2.65	3.07	18	0.42
77	21	21	3.29	3.94	19	0.65
79	23	24	3.86	4.16	19	0.30
84	28	25	3.84	3.85	13	0.01
86	30	26	3.60	3.14	19	0.14 ?
87	31	27	4.05	4.05	19	0.00
88	32	$\frac{29+30}{2}$	3.[illegible]	3.06		

$\bar{x} = 3.192$ (all trees, 66–77)

$\bar{x} = 3.797$ (selected trees, 66–77)

Pre-thinning mean diff. = 0.60

Average % superiority (66–77: pre-thinning)

$$= \frac{3.797 - 3.192}{3.192} = .190 = 19\%$$

AC-4

RESIDUAL TREES (Residual as of Mar 1987)

13 Nov 87

	Row	Column	Records, Column 24 (age 23) 1979	25 (age 28) 1984	26 (age 30) 1986 (3e ȳ)	27 (age 31) 1987	4-yr $\bar{y}$	$y\sigma_{n-1}$	n	4 yr 733	Class of Highest reading
738	1	6	40	36	24 33	31	3.28	.69	4		3.6-4.0
✓733	1	8	35	37	32 35	47	3.78	.65	4	3.78	4.6-5.0
✓733	1	13	58	47	38 48	56	4.98	.92	4	4.98	5.6-6.0
929	1	26	55	37	24 47	38	3.85	1.27	4		5.1-5.5
✓769	1	27	34		28 31	37	3.30	.46	3		3.6-4.0
✓733	1	30	40	37	28 35	48	3.82	.83	4	3.82	4.6-5.0
927	1	36	38		30 34	44	3.73	.70	3		4.1-4.5
✓733	1	43	45		29 37	42	3.87	.85	3	3.87	4.1-4.5
✓929	2	43	33	39	34 35	44	3.75	.51	4		3.6-4.0
✓733	2	30	41	42	32 38	34	3.72	.50	4	3.72	4.1-4.5
✓733	2	24	33		27 30	27	2.90	.35	3	2.90	3.1-3.5
922	2	20	34		30 32	25	2.97	.45	3		3.1-3.5
✓733	2	1	50	37	32 40	43	4.05	.78	4	4.05	4.6-5.0
✓769	3	11	29	39	37 35	47	3.80	.74	4		4.6-5.0
✓733	3	19	46	39	38 41	41	4.10	.36	4	4.10	4.6-5.0
✓733	3	24	41		28 34	35	3.47	.65	3	3.47	4.1-4.5
770	3	30	57	37	30 41	40	4.10	1.15	4		5.6-6.0
✓733	3	36	41	36	43 40	54	4.35	.76	4	4.35	4.1-4.5
✓733	3	40	41	38	32 37	37	3.70	.37	4	3.70	4.1-4.5
					3.70						
		$\bar{y}$	4.16	3.85	3.14	4.05	3.76	.48	19	3.89	
							± 0.476			± 0.52	

	No. trees	$\bar{x}$	
733	11	3.9	(358 × 356)
738	1	3.3	(358 OPEN)
769	2	3.6	(359 × 356)
770	1	4.1	(359 × 362)
922	1	3.0	(360 SELF)
927	1	3.7	(368 OPEN)
929	2	3.8	(368 × 356)

12 trees	$\bar{y}$	4.32	3.86	3.26		
8 trees	$\bar{y}$	4.62	3.86	3.30	4.61	$\bar{x}$ = 4.10 ± 0.6

N ↖

AC-4 RESIDUAL TREES 6 Mar. 87

(Column 27)

Page 32

R C	RI	Correction	Corrected %
1 6	738	+ 0.8	3.1
1 8	733	0.7	4.7
1 13	733	+ 0.4	5.6
1 26	929	+ 0.4	3.8
1 27	769	+0.4	3.7
1 30	733	+0.4	4.8
1 36	927	+0.4	4.4
1 43	733	+0.2	4.2
2 43	929	+0.2	4.4
2 30	733	+0.2	3.4
2 24	733	+0.1	2.7
2 20	922	+0.1	2.5
2 1	733	+0.1	4.3
3 11	769	+0.1	4.7
3 19	733	+0.1	4.1
3 24	733	+0.1	3.5
3 30	770	+0.1	4.0
3 36	733	+0.1	5.4
3 40	733	+0.1	3.7

$n = 19$

$\bar{x} = 4.053 = 4.1$

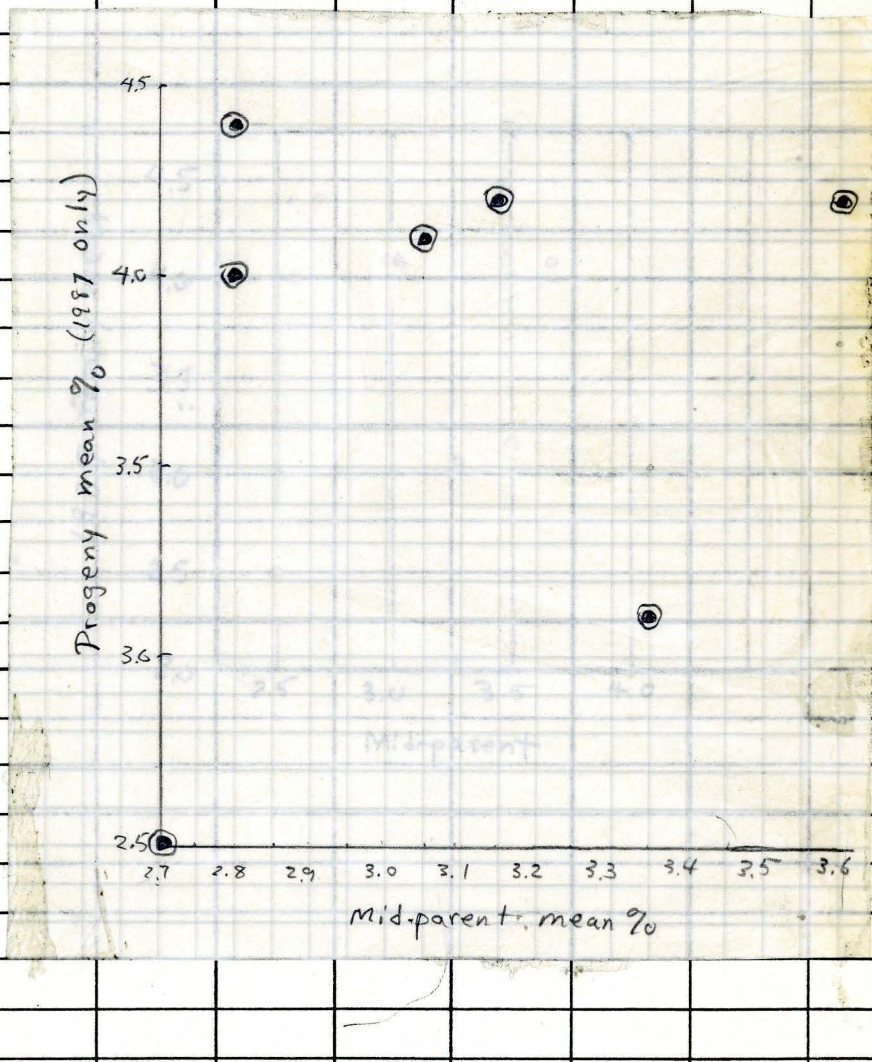
$\Sigma x = 77$

$\Sigma x^2 = 324.18$

$\sigma_n = 0.7989$

$\sigma_{n-1} = 0.8208$

	n	$\bar{x}$	σ_{n-1}
733	11	4.2	0.9
738	1	3.1	
769	2	4.2	0.7
770	1	4.0	
922	1	2.5	
927	1	4.4	
929	2	4.1	0.4

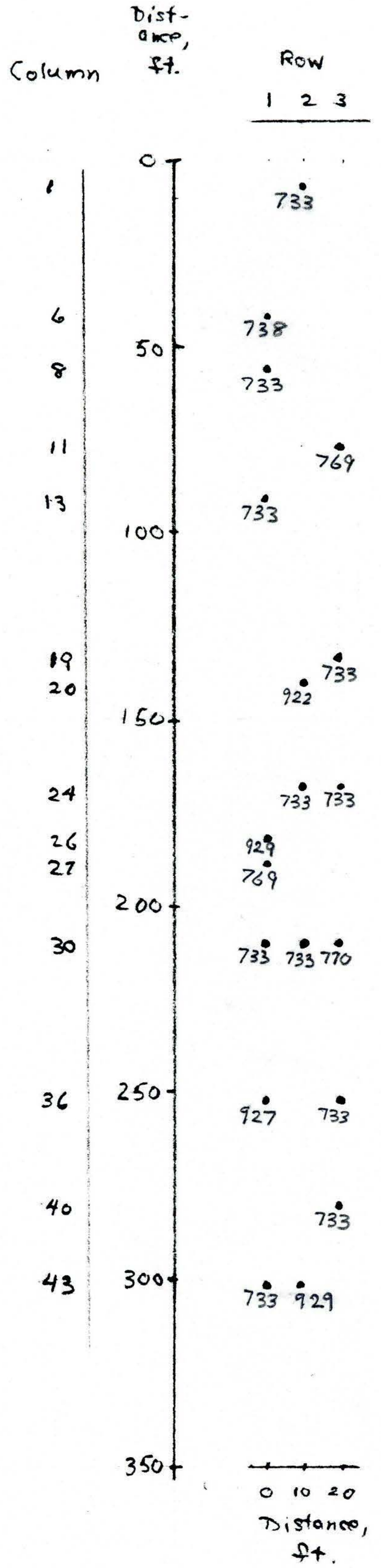


AC-4

POST-ROGUING MAP (As of March 1987)

Scale: 1" = 50'

Family number



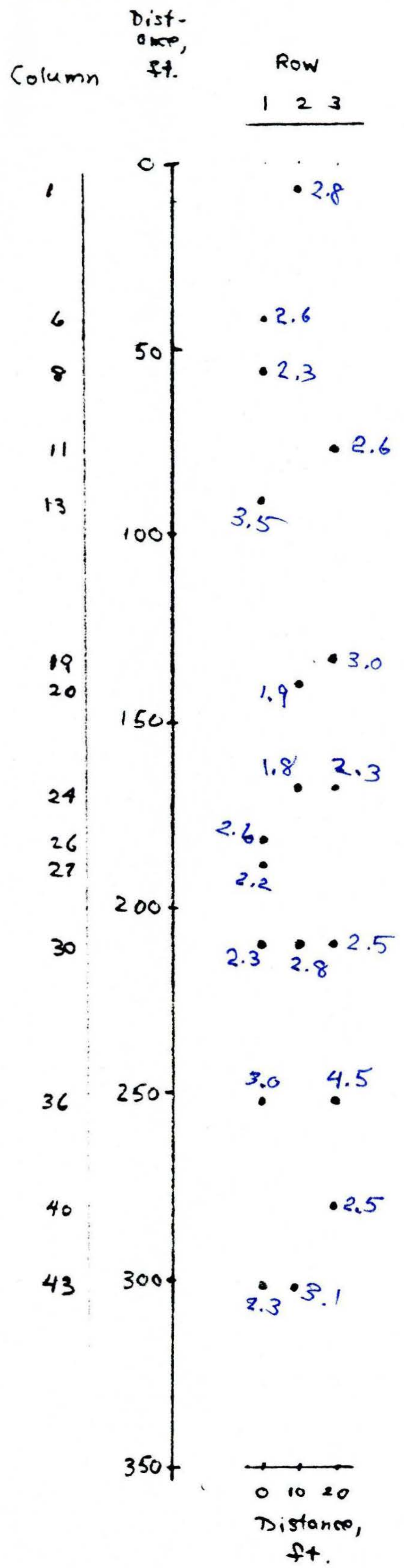
(column 30)

AC-4
POST-ROGUING MAP

(As of March 1987)

10 Mar 88

Scale: 1" = 50'



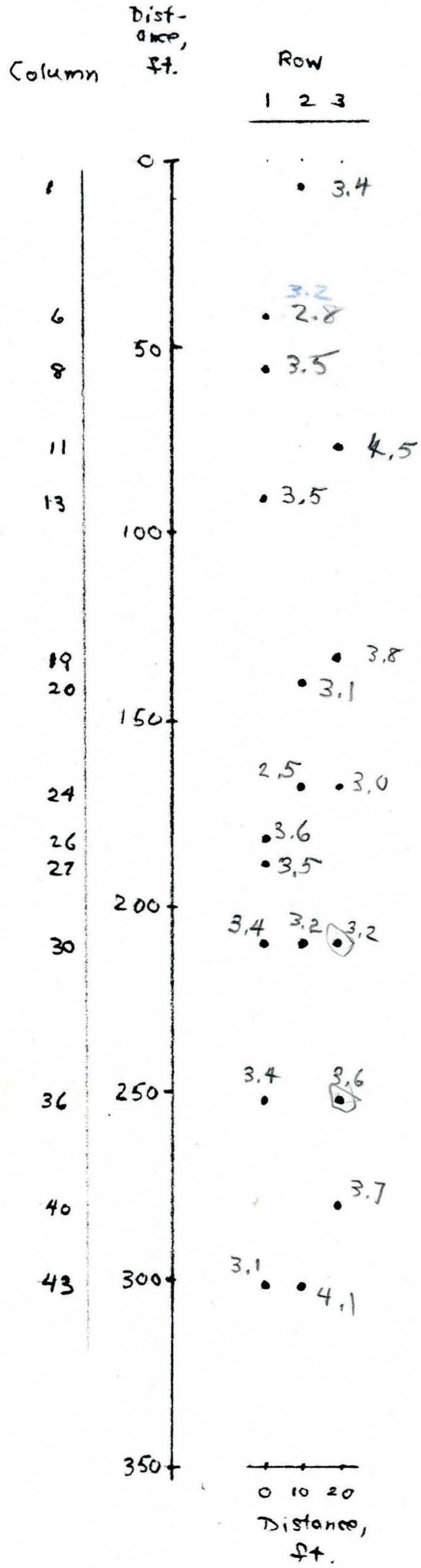
(column 29)

AC-4
POST-ROGUING MAP

(As of March 1987)

2/29/88

Scale: 1" = 50'



$n = 19$

$\bar{y} = 3.426$

$\sigma_{n-1} = 0.437$

O = not healthy

10 Mar 88
(Col. 30)

AC-4 RESIDUAL TREES

3 Mar. 88 (Column 29)

88

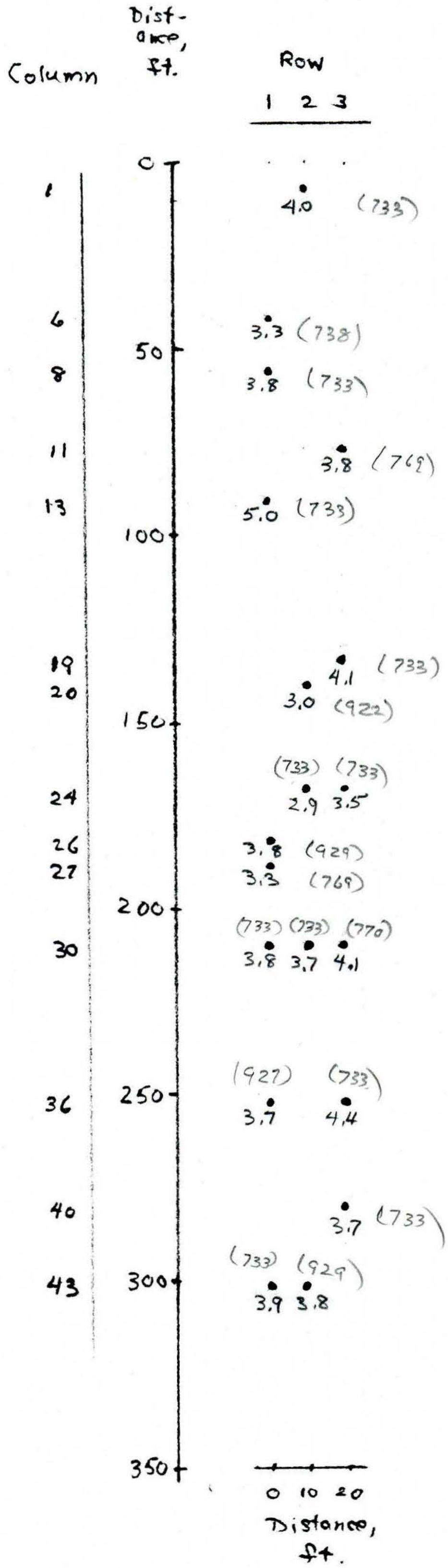
R-C	Fam.	~~2/29/88~~ (Col. 29)	5-yr $\bar{y}$	To be rogued out		10 Mar 88 (Col. 30)	average of 29 Feb & 10 Mar. 88	age 23-32 5-yr $\bar{y}$	5 yr, 733 only		1987-88 av. ages 31-32	
1 6	738	2.8	3.18	√		2.6	2.7	3.16				
1 8	733	3.5	3.72			2.3	2.9	3.60	3.60	√ √	3.8	
1 13	733	3.5	4.68			3.5	3.5	4.68	4.68	√ √	4.6	
1 26	929	3.6	3.80			2.6	3.1	3.70		√ √	3.4	
1 27	769	3.5	3.34	√		2.2	2.8	3.20				
1 30	733	3.4	3.74			2.3	2.8	3.62	3.62	√ √	3.8	
1 36	927	3.4	3.66			3.0	3.2	3.62			3.8	
1 43	733	3.1	3.72			2.3	2.7	3.64	3.64	√ √	3.4	
2 43	929	4.1	3.82	√	Tree not healthy	3.1	3.6	3.72				
2 30	733	3.2	3.62	√		2.8	3.0	3.58	3.58			
2 24	733	2.5	2.82	√		1.8	2.2	2.76	2.76			
2 20	922	3.1	3.00	√		1.9	2.5	2.88				
2 1	733	3.4	3.92			2.8	3.1	3.86	3.86	√ √	3.7	
3 11	769	4.5	3.94			2.6	3.6	3.76			4.2	
3 19	733	4.1	4.10			3.0	3.6	4.00	4.00	√ √	3.8	
3 24	733	3.8	3.54			2.3	3.0	3.38	3.38		3.2	
3 30	770	3.2	3.92	√	Tree not healthy	2.5	2.8	3.84				
3 36	733	3.6	4.20			4.5	4.0	4.28	4.28	√ √	4.7	
3 40	733	3.7	3.70			2.5	3.1	3.58	3.58		3.4	
	Σ	66.00	70.42			50.60	58.20	68.86	40.98		45.80	
	n	19	19			19	19	19	11		12	
	$\bar{y}$	3.474	3.706			2.663	3.063	3.624	3.725		3.817	
	σ_{n-1}	0.464	0.425			0.608	0.442	0.446	0.494		0.473	
						733	11	3.725	3.7			
						738	1	3.160	3.2			
						769	2	3.480	3.5			
						770	1	3.840	3.8			
						922	1	2.880	2.9			
						927	1	3.620	3.6			
						929	2	3.710	3.7			
					Σ			45.72			27.84	
					n			12			7	
					$\bar{y}$			3.810			3.977	
					σ_{n-1}			0.359			0.384	

AC-4

POST-ROGUING MAP (As of March 1987)

Scale: 1" = 50'

Average Sugar %
(1979 - 87)
19 trees

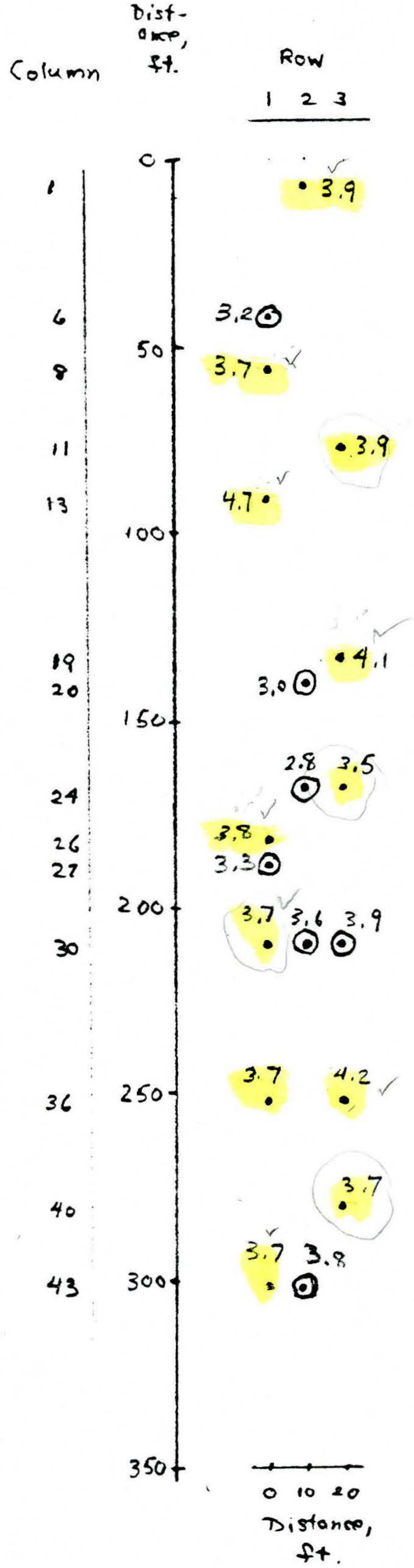


AC-4

POST-ROGUING MAP (As of March 1987)

5-yr
$\bar{y}$
(1979-88)

Scale: 1" = 50'



O = Marked for roguing 3 Mar. 88

✓ = trial, to 8 trees, min separation ≥ 8' = 8.5 m. (Trees 1-26 and 1-30)

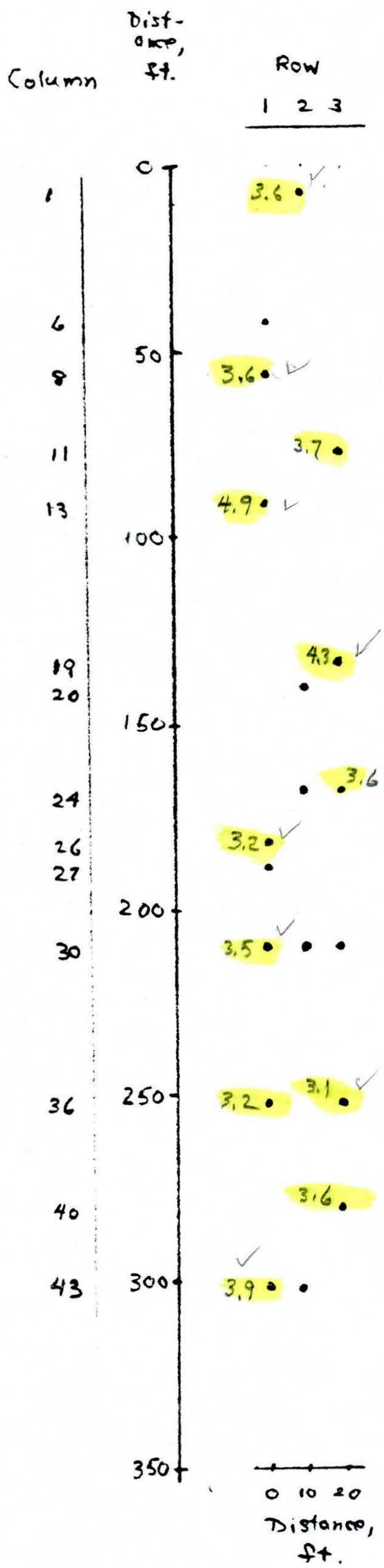
0.22 acres
0.089 ha

AC-4

POST-ROGUING MAP (As of March 1987)

3-yr
(1964, 1966, 1969)
- pre-thinning, for comparison with Holden

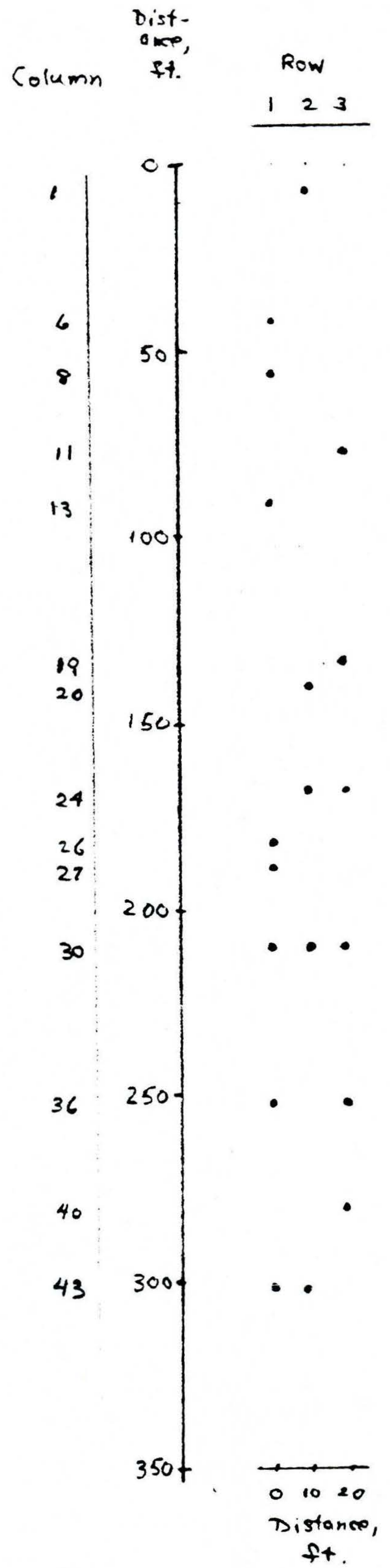
Scale: 1" = 50'



AC-4
POST-ROGUING MAP

(As of March 1987)

Scale: 1" = 50'



AC-4

(for comparison with Holden Arboretum bulk progeny test of AC-1)

	1962-65 $\bar{y}$		(ages 7-10 from seed)				No. trees (n)	$(\bar{y})(n)$	$\bar{y}$ weighted			
% of	(Column 10											
trees	in AC-4 book)			$\bar{y}$	= 2.58 ±.74							
in class												
.5	0.26 -	0.75										
2 1.0	0.76 -	1.25	||				2	2.0				
6 1.5	1.26 -	1.75	𝍸 |				6	9.0				
28 2.0	1.76 -	2.25	𝍸 𝍸	𝍸 𝍸	𝍸 ||||		29	58.0				
32 2.5	2.26 -	2.75	𝍸 𝍸	𝍸 𝍸	𝍸 𝍸	|||	33	82.5	2.57			
15 3.0	2.76 -	3.25	𝍸 𝍸	𝍸 |			16	48.0				
10 3.5	3.26 -	3.75	𝍸 𝍸				10	35.0				
4 4.0	3.76 -	4.25	||||				4	16.0				
1 4.5	4.26 -	4.75	|				1	4.5				
2 5.0	4.76 -	5.25	||				2	10.0				
	5.26 -	5.75										
	5.76 -	6.25										
							103	265				
				'64, '66, '69								
	1964-65		(ages 8,10,13)									
(Col's 16, 15, 19:	($\bar{y}$)						(n)	$(\bar{y})(n)$	$\bar{y}$ weighted			
.5	.26 -	.76										
1.0	.76 -	1.25			$\bar{y}$ = 3.12		± 0.6521			%		
1.5	1.26 -	1.75								of trees		
2.0	1.76 -	2.25	𝍸 ||				7	14.0		8.9		
2.5	2.26 -	2.75	𝍸 𝍸	𝍸 ||			17	42.5		21.5		
3.0	2.76 -	3.25	𝍸 𝍸	𝍸 𝍸	||		22	66.0		27.8		
3.5	3.26 -	3.75	𝍸 𝍸	𝍸 ||||			19	66.5	3.12	24.0		
4.0	3.76 -	4.25	𝍸 𝍸	||			12	48.0		15.2		
4.5	4.26 -	4.75	|				1	4.5		1.3		
5.0	4.76 -	5.25	|				1	5.0		1.3		
							79	246.5				

(USED THESE DATA)

PARENTS ♀, ♂, MID-

♀ Parents (thru 1960)	
358	3.9
356	3.3
359	3.0
368	2.8
360	2.7
362	2.6
$\bar{x}$	3.05

Mid-parents

733 = 358 × 356 = (3.9 + 3.3)/2 = 3.60
770 = 359 × 362 = (3.0 + 2.6)/2 = 2.80
929 = 368 × 356 = (2.8 + 3.3)/2 = 3.05
738 = 358 × OPEN = (3.9 + 2.8)/2 = 3.35
769 = 359 × 356 = (3.0 + 3.3)/2 = 3.15
921 = 359 × OPEN = (3.0 + 2.8)/2 = 2.90
924 = 360 × OPEN = (2.7 + 2.8)/2 = 2.75
737 = 358 × 362 = (3.9 + 2.6)/2 = 3.25
(922+930) = 360 × 360 = (2.7+2.7)/2 = 2.70
927 = 368 × OPEN = (2.8 + 2.8)/2 = 2.80
925 = 362 × OPEN = (2.6 + 2.8)/2 = 2.70
(736+739) = 358 × 358 = (3.9 + 3.9)/2 = 3.90
923 = 360 × 356 = (2.7 + 3.3)/2 3.00

Recorded ♂ trees		
356	(4)	3.3
360	(8)	2.7
362	(10)	2.6
366	(14)	2.7
$\bar{x}$		2.825

all tested trees (9)

$\bar{x}$ = 2.85

Average of pollen trees = 2.82
use for male parent in calculating mid-parent

Note: All parent means as in Proc. 5th World Forestry Congress 1960

	♂ parent	Controlled-pollinated families*	mid-parents	no. of trees in family
733	356	3.83	3.60	15
737		3.12	3.25	4
769	356	3.49	3.15	5
770		3.23	2.80	2
923	356	1.87	3.00	1
929	356	3.92	3.05	2

* means col's 6, 19, 21 See p. 2
(3 pre-thinning yrs w height readings)

AC-4

Data analyses made

(A) individual tree regressions

1. Regression of all tree means on midparent means (Before thinning, 7 years)

2. Regression of all tree means on midparent means (Before thinning, 3 years with high readings)

3. Regression of selected tree means on midparent means (Before and after thinning, 9 years)

(B) Family mean regressions

1. Weighted regression of family means on midparent means (Before thinning, 7 years)

2. Weighted regression of family means on midparent means (Before thinning, 3 years with high readings)

3. Weighted regression of family means (selected trees) on midparent means (Before and after thinning, 9 yea

(15A)

<u>Before Thinning</u> (Columns 6, 15 16, 17, 19, 20, 21)*

Analysis of Correlation and regression based on family means, 8 families (56 trees)

Fam.	X	Y	n
733	3.60	3.44	11
738	3.35	3.18	5
769	3.15	3.29	5
925	2.70	2.61	9
927	2.80	2.78	10
921	2.90	2.95	12
924	2.75	3.25	2
922-30	2.70	3.14	2

(Unweighted means)

r = 0.6620744

a = Intercept = 1.4426499

b = Slope = 0.5469228

$\bar{X}$ = 2.9937500 ± 0.3156714 (σ_n)

$\bar{Y}$ = 3.0800000 ± 0.2607681

h^2 = 0.55

* Only trees with a reading in each of the above columns

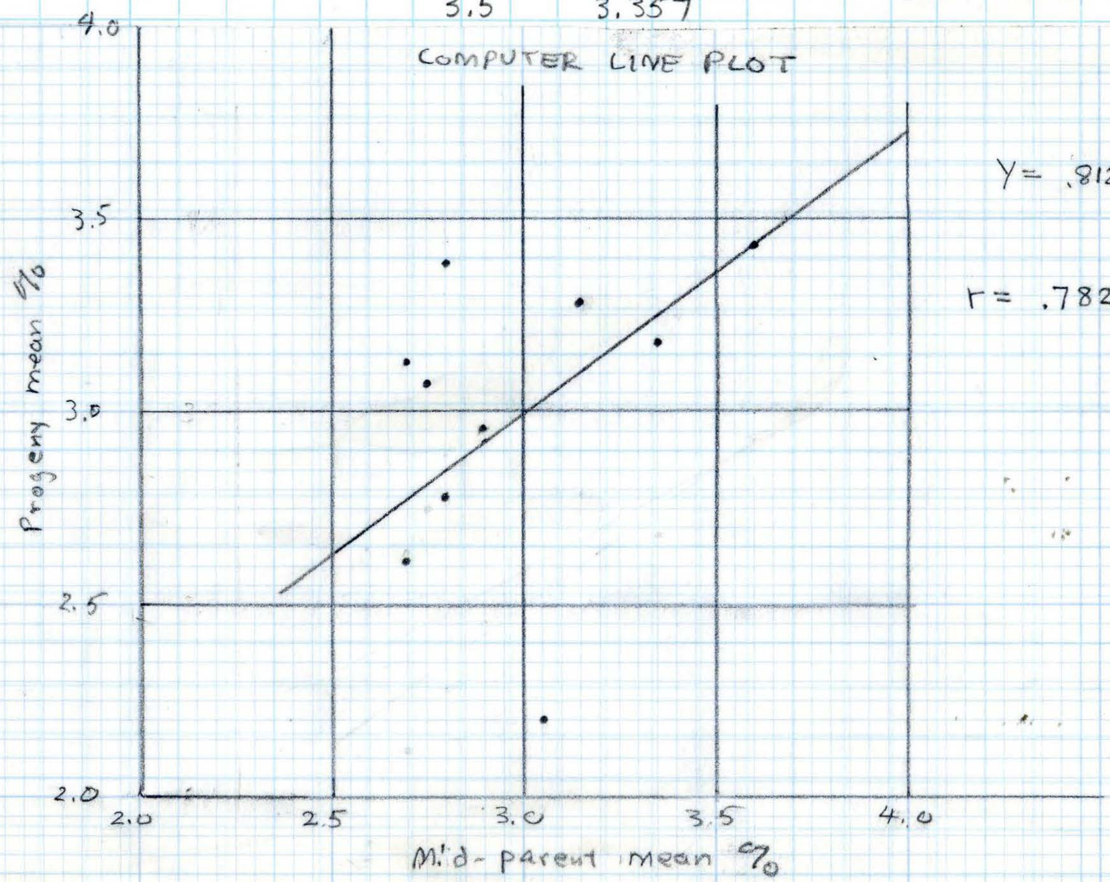
Line points:

X	Y
2.5	2.810
3.0	3.083
3.5	3.357

Weighted (line below)

X	Y

See computer printout



Y = .812 + .728X

r = .782 ± .214

Before Thinning

*MEANS, COLUMNS 6, 19, 21

	Exclude from 7-date tally	Mid-parent X	733 Y			Mid-parent X	925 Y 362 x OP			Mid-parent X	921 Y 359 x OP	
		3.60	3.70			2.70	3.33			2.90	2.80	
		3.60	4.10			2.70	2.07			2.90	3.33	
		3.60	4.70			2.70	2.93			2.90	2.63	
		3.60	4.10			2.70	2.53			2.90	3.10	
		3.60	3.23			2.70	2.67			2.90	3.07	
		3.60	3.03			2.70	3.07			2.90	3.60	
		3.60	3.83			2.70	2.87			2.90	2.70	
		3.60	4.53			2.70	2.13			2.90	3.00	
		3.60	3.07			2.70	2.97			2.90	3.47	
		3.60	3.47			2.70	2.67			2.90	3.00	
		3.60	2.93			2.70	3.00			2.90	3.27	
		3.60	4.07			(11) $\bar{Y}$=	2.75			2.90	3.10	
		3.60	3.93			σ_{n-1} =	0.388			2.90	4.07	
		3.60	4.27				368 x OP			2.90	3.23	
		3.60	4.63			Mid-parent	927			(14)	3.17	
		(15) $\bar{Y}$=	3.83			X	Y			σ_{n-1} =	0.377	
		σ_{n-1} =	0.587			2.80	2.87				360 x OP	
			358 x OP			2.80	2.97			Mid-parent	924	
		Mid-parent	738			2.80	3.07			X	Y	
		X	Y			2.80	4.13			2.75	3.77	
		3.35	3.97			2.80	3.27			2.75	3.35	
		3.35	3.63			2.80	2.37			(2)	3.56	
		3.35	3.00			2.80	2.77			σ_{n-1} =	0.297	
		3.35	3.37			2.80	3.10					
		3.35	3.53			2.80	2.93	Mid-parent	737	Mid-parent	922-930	
		(5) $\bar{Y}$=	3.50			2.80	2.40	X	Y	X	Y	
		σ_{n-1} =	0.356			2.80	3.33	3.25	3.10	2.70	2.97	
						2.80	2.93	3.25	2.43	2.70	3.70	
		Mid-parent	769			(12)	3.01	3.25	3.80	(2)	3.34	
		X	Y			σ_{n-1} =	0.458	3.25	3.17	σ_{n-1} =	0.516	
		3.15	3.10					$\bar{Y}$ =	3.12			
		3.15	3.60			Mid-parent	929	σ_{n-1} =	0.56	Mid-parent	770	
		3.15	3.40			X	Y			X	Y	
		3.15	3.57			3.05	4.33	With Mosaic plot calc.		2.80	3.73	
		3.15	3.77	σ_{n-1}		3.05	3.50 ←			2.80	2.73	
		(5)	3.49	± 0.254		$\bar{Y}$ =	3.9			(2)	3.23	± 0.707
		Mid-parent	736-739			Mid-parent	737			Mid-parent	923	
*Each	value is	X	Y			X 3.25	Y 2.43	$\bar{Y}$		X	Y	
	a mean		2.57		(2)	3.25	3.10	$\bar{Y}$=	2.76	3.00	1.87	

Before Thinning (Columns 6, 19, 21) 2 A

Analysis of correlation and regression based on family means, 10 families (70 trees)

Fam.	X	Y	n
733	3.60	3.83	15
738	3.35	3.50	5
769	3.15	3.49	5
925	2.70	2.75	11
927	2.80	3.01	12
737	3.25	2.76	2
921	2.90	3.17	14
924	2.75	3.56	2
922-30	2.70	3.34	2
770	2.80	3.23	2

(Unweighted means)

$r = 0.4540652$

a = Intercept = 1.749000

b = Slope = 0.50500

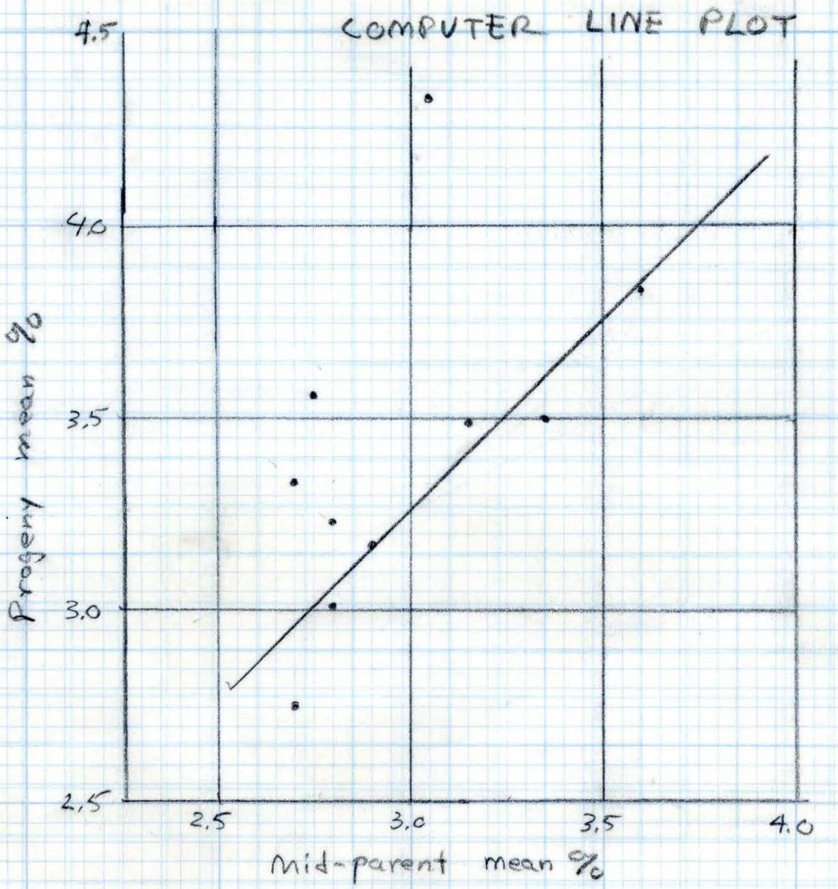
$\bar{X} = 3.000 \pm 0.3000000$ (σ_n)

$\bar{Y} = 3.26400 \pm 0.3336525$

$h^2 = 0.51$

*Only trees with a reading in each of the above columns

Line points: X = 2.5, Y = 3.01; X = 3.0, Y = 3.26; X = 3.5, Y = 3.52



$Y = .275 + .995X$

$r = .868 \pm .217$

Before Thinning

*MEANS, COLUMNS 6, 19, 20, 21, 15, 16, 17

Exclude from 7-date tally: [redacted]

Mid-parent X	733 Y
3.60	3.29
3.60	3.59
3.60	3.61
3.60	3.27
3.60	4.16
3.60	3.11
3.60	3.41
3.60	2.69
3.60	3.60
3.60	3.43
3.60	3.64
11 [redacted] $\bar{Y}$ =	3.44

[redacted]

Mid-parent X	738 Y
3.35	3.40
3.35	3.21
3.35	2.93
3.35	3.14
3.35	3.21
(5) $\bar{Y}$	3.18

Mid-parent X	769 Y
3.15	2.74
3.15	3.46
3.15	3.23
3.15	3.14
3.15	3.86
(5) $\bar{Y}$=	3.29

Mid-parent X	736 ~~739~~

Mid-parent X	925 Y
2.70	3.11
2.70	2.13
2.70	2.61
[redacted] 2.70	2.43
2.70	2.69
2.70	2.63
2.70	2.13
2.70	2.97
2.70	2.80
9 [redacted] $\bar{Y}$ =	2.61

Mid-parent X	927 Y
2.80	2.53
2.80	2.87
2.80	3.63
2.80	3.04
2.80	2.41
2.80	2.89
2.80	2.69
2.80	2.27
[redacted] 2.80	2.94
2.80	2.53
10 $\bar{Y}$ =	2.78

Mid-parent X	929 Y
3.05	2.20

Mid-parent X	737
[redacted] 3.25	
3.25	

Mid-parent X	921 Y
2.90	2.40
2.90	3.23
2.90	2.87
2.90	2.96
2.90	2.81
2.90	3.24
2.90	2.63
2.90	2.66
2.90	3.24
[redacted] 2.90	2.69
[redacted] 2.90	3.64
2.90	3.07
12 $\bar{Y}$ =	2.95

Mid-parent X	924 Y
2.75	3.46
2.75	3.04
(2)	3.25

Mid-parent X	922-930 Y
2.70	3.24
2.70	3.03
(2)	3.14

Mid-parent X	770 Y
2.80	3.39
[redacted]	

Mid-parent X	923
[redacted] 3.00	

* Each value is a mean

~~After thinning~~

*MEANS, COLUMNS 6, 19, 20, 21, 15, 16, 17, 24, 25

Exclude from 7-date tally	Mid-parent X	733 Y
	3.60	3.70
	3.60	4.70
	3.60	3.70
	3.60	4.20
	3.60	3.30
	3.60	3.40
	3.60	3.90
	3.60	3.70
	3.60	3.70
	3.60	3.80
10	$\bar{x}$ =	3.81

	Mid-parent X	738 Y
	3.35	3.60
	3.35	3.40
	3.35	3.50
3	$\bar{x}$ =	3.50

	Mid-parent X	769 Y
	3.15	3.60
	3.15	3.53
2	$\bar{x}$	3.56

Mid-parent X	736 ~~739~~ Y
X	

Mid-parent X	925 Y
2.70	2.93
(11)	

Mid-parent X	927 Y
2.80	3.10
2.80	3.40
2.80	3.10
$\bar{x}$	3.20

Mid-parent X	929 Y
3.05	3.50

Mid-parent X	737 Y
3.25	3.30

Mid-parent X	921 Y
2.90	3.40
2.90	3.20
2.90	3.30
2.90	3.60
$\bar{x}$	3.38

	Mid-parent X	924 Y
	2.75	3.50
	2.75	3.10
$\bar{x}$	(2)	3.30

Mid-parent X	922-930 Y
2.70	3.30
2.70	3.10
(2)	3.20

Mid-parent X	770 Y
2.80	3.70

Mid-parent X	923 Y
3.00	

*Each value is a mean

age (8) (10) (10) (10) (13) (17) (21)

After Thinning (Columns 6, 15, 16, 17, 19, 20, 21, 24, 25*) ③ (A)

Analysis of family means, 7 families

Fam.	X	Y	n
733	3.60	3.81	10
738	3.35	3.50	3
769	3.15	3.56	2
927	2.80	3.20	3
921	2.90	3.38	4
924	2.75	3.30	2
922-30	2.70	3.20	2
			26

(Unweighted means)

r = 0.9464504 $p < .01$

(p .01 = .875)

(p .001 = .951)

a = Intercept = 1.567408

b = Slope = 0.6107362

$\bar{X}$ = 3.0357143 $h^2 = 0.61$

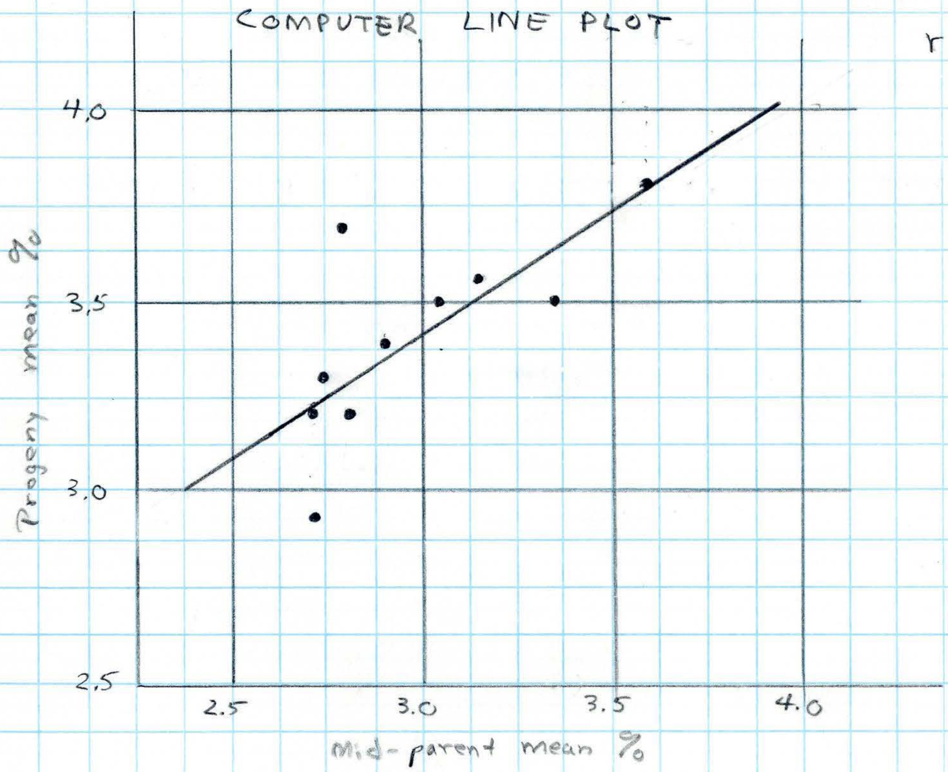
$\bar{Y}$ = 3.4214286

* Only trees with a reading in each column

Line points:

X	Y
2.5	3.094
3.0	3.400
3.5	3.705

Y = 1.567 + 0.611 X



r = .903 ± .124

DATA NOT VALID (x means off)
-retained to show individual tree scatter

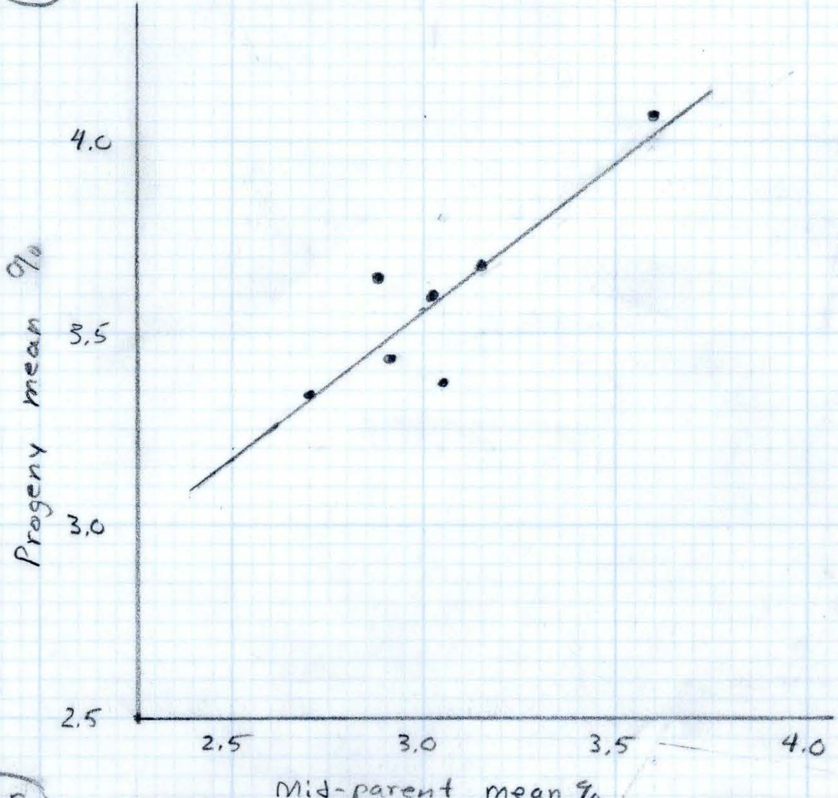
AC-4

CORRELATION OF OFFSPRING MEAN SUGAR % WITH MID-PARENT MEAN SUGAR %, FOR TREES REMAINING AFTER ROGUING *

(A)

COLUMN 28 (rev.) - 7 family means (27 trees)

(includes 1 2-tree selfed family)
no 1-tree families



$r = 0.84514$ $p < .05$

$\left(\begin{array}{l} p .05 = .755 \\ p .01 = .875 \end{array} \right)$

$Y = 1.549 + 0.660 X$

$\bar{x} = 3.0457143 \pm \overline{0.2622898}^{\sigma_n}$

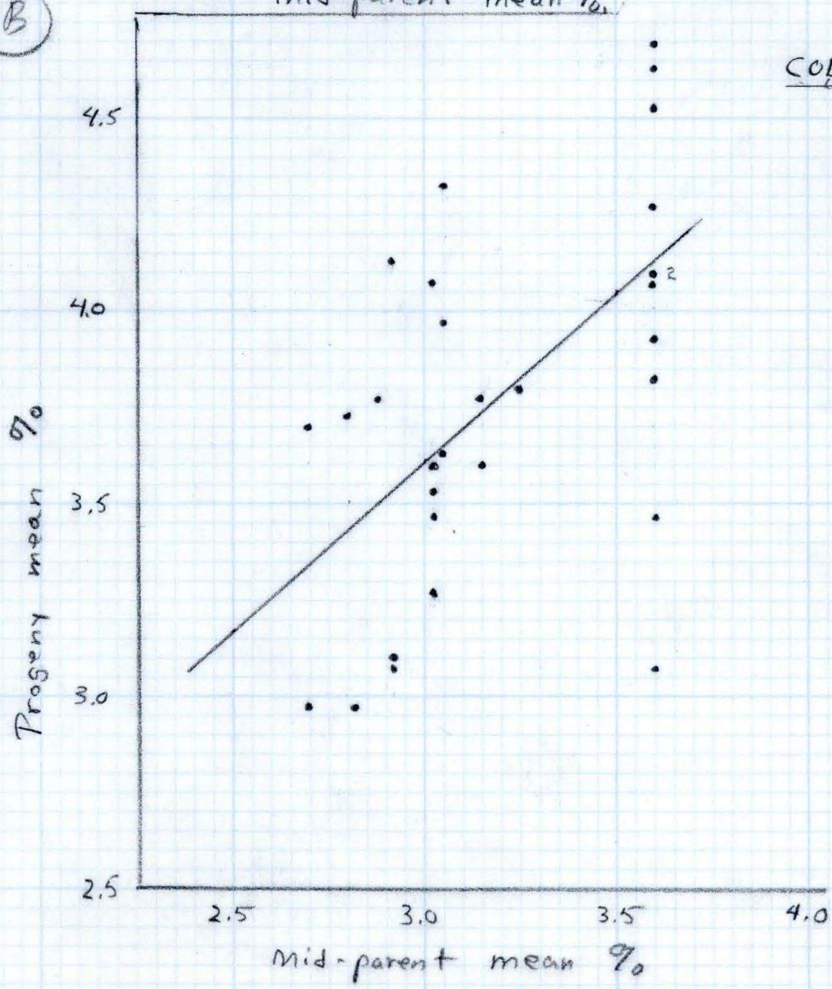
$\bar{y} = 3.5785714 \pm 0.208842$

$a = 1.5486675$

$b = 0.6664788$

(B)

COLUMN 28 (rev.) Individual means
(32 trees)



$r = 0.5712111$ $p < .05$

$(p .05 = .355)$

$(p .01 = .456)$

$Y = 0.972 + 0.881 X$

$\bar{x} = 3.2053125 \pm 0.3255091$

$\bar{y} = 3.7946875 \pm 0.5017904$

$a = 0.9722372$

$b = 0.8805538$

* Each mean is the mean of 3 measurements (columns 6, 19, 21)

16 Sept. 87

AC-4

COLUMN

Don't use (not based on all measurements of parent trees)

RANKING (3/87 SUMM., MEAS.'s 1-12 $\bar{x}$, excluding #2

	Family	# trees	$\bar{x}$
1.	733 (358 x 356)	11	3.78
2.	770 (359 x 362)	1	3.67
3.	769 (359 x 356)	3	3.60
4.	929 (368 x 356)	2	3.60
5.	738 (358 x Open)	3	3.40
6.	921 (359 x Open)	5	3.34
7.	924 (360 x Open)	2	3.30
8.	922+930 (360 x 360)	2	3.30
9.	737 (358 x 362)	4	3.30
10.	927 (368 x Open)	4	3.26
11.	925 (362 x Open)	1	2.93
12.	739 (358 x 358)	1	2.90

PARENT RANKING

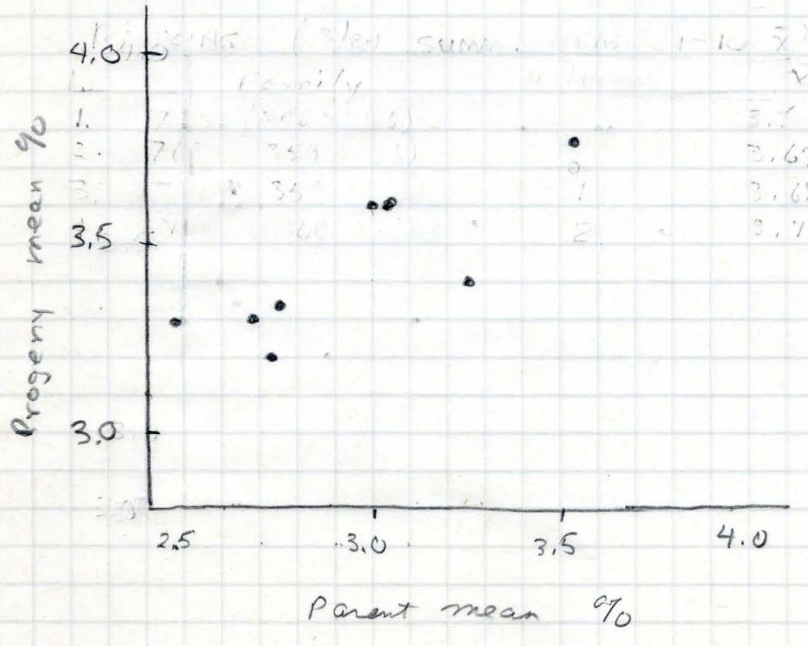
1.	358	3.90	~~3.63~~
2.	356	3.30	~~3.43~~
3.	359		2.64
4.	362		2.59
5.	368		2.56
6.	360		2.49
			$\bar{x}$ = 2.89

Mid-Parent means

(358+356), $\bar{x}$ = ~~3.53~~ 3.6
(359+362), $\bar{x}$ = 2.62 omit
(359+356), $\bar{x}$ = 3.04
(368+356), $\bar{x}$ = 3.00
(358 + $\bar{x}$ (6 trees) = 3.26
(359 + " = 2.76
(360 + " = 2.69
(360 + 360), $\bar{x}$ = 2.49
(358 + 362), $\bar{x}$ = 3.11 omit
(368 + $\bar{x}$ (6 trees) = 2.72
(362 + $\bar{x}$ (6 trees) = 2.74 om
(358 + 358), $\bar{x}$ = 3.63 om
(360 + 356) $\bar{x}$ = 2.96

	356	358	359	360	362	368	Open
356							
358	3.78	2.90			3.30		3.40
359	3.60				3.70		3.34
360				3.14			3.30
362							2.93
368	3.60						3.20

Parent - Progeny (families with 2 or more trees, measurements 1-12, excl. #2 (in some cases based on 1-10, excl. #2)



March '79

March '84

AC-4

Residual Trees - Averages (cumulative)

① All families

March '79:

♀ \ ♂	356	358	360	362	OPEN
358	3.6	3.0		3.3	3.5
359	3.7			3.6	3.3
360			3.2		3.2
362					2.9
368	3.8				3.2

March '84:

	356	358	360	362	OPEN
358	3.7	2.9		3.3	3.4
359	3.7			3.7	3.4
360			3.3		3.3
362					3.0
368	3.8				3.4

② Families with 2 or more trees

March '79:

♀ \ ♂	356	358	360	362	OPEN
358	3.6				3.5
359	3.7				3.3
360			3.2		3.2
362					
368	3.8				3.2

March '84:

	356	358	360	362	OPEN
358	3.7				3.4
359	3.7				3.4
360			3.2		3.3
362					
368	3.8				3.4

③ Two best trees in family ($\bar{x}$)

March '79:

♀ \ ♂	356	358	360	362	OPEN
358	4.4				3.5
359	3.8				3.4
360			3.2		3.2
362					
368	3.8				3.4

March '84:

	356	358	360	362	OPEN
358	4.4				3.5
359	3.8				3.6
360			3.3		3.3
362					
368	3.8				3.4

OHIO AGRICULTURAL EXPERIMENT STATION

WOOSTER, OHIO

Sugar Maple Controlled Pollination
Progeny Test

% sugar

Plantation AC-4

9 March 86

(Column 26)

N

Crosses: April, 1955 by PH, HK
Planted: Nov., 1959
Spacing: c.7' x 10'
Design: complete randomization
Location: Apple Creek State Hospital, Apple Creek, Ohio

925 ?

			3.2	733		
					2.4	769
		925			3.7	921
4				925		921
		733	2.3	921		921
	2.4	738		929	1.9	739
		769				927
8	3.2	733		921		925
		925		921		
		736		927		738
	3.2	733		921	3.7	769
12		925		737		921
	3.8	733		733		921
	?	736	3.1	930	2.7	921
	3.9	927		927		926
16				927		922
		921		927		925
		927		921		927
		738		927	3.8	733
20		925	3.0	922	2.2	927
		921				923
		921		925		739
		737		738	2.5	737
24		921	2.7	733	2.8	733
	2.4	738				737
	2.4	929		921		921
	2.8	769		733		924
28	?		3.2	925		927
				930		923
	2.8	733	3.2	733	3.0	770
				737		921
32		733		925		927
		925		769		738
	2.4	927				927
	2.7	733		921		738
36	3.0	927		930	4.3	733
		927		921		921
				921		736
		733			3.4	921
40				925	3.2	733
		921		769		925
		925	2.8	924		733
	2.9	733	3.4	929		921
44		925		925		927
		769				770

Key (all parent trees were roadside trees at O.A.R.D.C., across from present Service Building)

Progeny Accession Number	Female Parent Number		Male Parent Number
733	358	x	356
735	356	x	open
736	358	x	358
737	358	x	362
738	358	x	open
739	358	x	unpollinated
769	359	x	356
770	359	x	362
921	359	x	open
922	360	x	unpollinated
923	360	x	356
924	360	x	open
925	362	x	open
926	362	x	unpollinated
927	368	x	open
929	368	x	356
930	360	x	360

HBK & CRB
4-5-65

Trees to be Retained

15 Mar 84 Tests (and preceding tests)

Ohio Agricultural Experiment Station
WOOSTER, OHIO

Sugar Maple Controlled Pollination
Progeny Test

(Column 25)

Plantation AC-4

Crosses: April, 1955 by PH, HK
Planted: Nov., 1959
Spacing: c.7' x 10'
Design: complete randomization
Location: Apple Creek State Hospital, Apple Creek, Ohio

N

1		3.7 733	
2			769
3	925		921
4		925	~~921~~
5	733	921	921
6	3.6 738	929	739
7	769		927
8	3.7 733	921	925
9	925	921	
10	736	927	738
11	733	921	3.9 769
12	925	737	921
13	4.7 733	733	921
14	736	930	921
15	927	927	926
16		927	922
17	921	927	925
18	927	921	927
19	738	927	3.9 733
20	925	922	927
21	921		923
22	921	925	739
23	737	738	737
24	921	733	3.7 733
25	738		737
26	3.7 929	921	921
27	769	733	924
28		925	927
29		930	923
30	3.7 733	4.2 733	3.7 770
31		737	921
32	733	925	927
33	925	769	738
34	927		927
35	733	921	738
36	927	930	3.6 733
37	927	921	921
38		921	736
39	733		921
40		925	3.8 733
41	921	769	925
42	925	924	733
43	733	3.9 929	921
44	925	925	927
45	769		770

Key (all parent trees were roadside trees at O.A.R.D.C., across from present Service Building)

Progeny Accession Number	Female Parent Number		Male Parent Number
733	358	x	356
735	356	x	open
736	358	x	358
737	358	x	362
738	358	x	open
739	358	x	unpollinated
769	359	x	356
770	359	x	362
921	359	x	open
922	360	x	unpollinated
923	360	x	356
924	360	x	open
925	362	x	open
926	362	x	unpollinated
927	368	x	open
929	368	x	356
930	360	x	360

HBK & CRB
4-5-65

TABLE 1 AC-4 March, '79

SUMMARY "Table 1"

CUMULATIVE PERFORMANCE OF RESIDUAL TREES

(not rogued in March, 1977 thinning)

Early and mid-season tests only

Pencil corrections omit col. 2

		(age)	(8)				(10)	(13)	(17)	(21)	(23)			(28)			(30)	(31)	
			1	2	3	4	5	6	7	8	9			10 (25)	10A	10B	11	12	
					AC-4 Record Book Columns														
R-C	Acc.	Cross	6	8	15	16	17	19	20	21	24	Σ col's 1-9	x̄ 1-9	15 Mar. 84	Σ col's 1-10	x̄ 1-10	9 Mar. 86	6 Mar 87	x̄ 1,3-12
1-8	733	358×356	46		34	35	24	41	38	33	35	286	3.6	45	331	3.7	32	47	3.7
1-11	733	" × "	46		27			33	23	30	33	146	2.9	37	183	3.0	32		
1-13	733	" × "	50		45	39	35	61	28		58	316	4.6	59	375	4.7	38	56	4.7
1-30	733	" × "	40	40	32	34	31	35	33	48	40	333	3.7	41	374	3.7	28	48	3.7
1-35	733	" × "	22 19				14		26	46	38	124	3.1	32	156	3.1	27		
1-43	733	" × "	48		30	30	25	43	29	24	45	274	3.4				29	42	3.4
2-30	733	" × "	64		36	36	50	34	33	38	41	332	4.2	48	380	4.2	32	34	4.1
2-27	733	" × "	40		32	29	36	25	29	27	38	256	3.2	38	294	3.3	32		
2-24	733	" × "	41		33	35	36	30	31	33	33	272	3.4	31	303	3.4	27	27	3.2
2-1	733	" × "			36		31	40	24	40	50	221	3.7	35	256	3.7	32	43	3.7
3-19	733	" × "	51		31	30	36	42		29	46	265	3.8	44	309	3.9	38	41	3.9
3-24	733	" × "	48		25	29	25	41	26	58	41	293	3.3	39	332	3.7	28	35	3.6
3-36	733	" × "	28	30	37	37	21	44	27	46	41	311	3.5	51	362	3.6 3.7	43	54	3.9
3-40	733	" × "	40		24	37	33	35	33	53	41	296	3.7	44	340	3.8	32	37	3.7
3-42	733	" × "	39		18		26	57	38	43	36	257	3.7						
	x̄	358×356	4.5		3.1		3.0				4.1		3.6	4.2		3.7 3.68			3.78
3-23	737	358×362	48		26	35	28	33	22	33	37	262	3.3	34	296	3.3	25	—	
	x̄	358×362											3.3	3.4		3.3			
1-6	738	358×OPEN	42	44	20	29	33	39	37	38	40	322	3.6	40	362	3.6	24	31	3.4
1-25	738	" × "	63		26	29	31	14	30	32	45	270	3.4	37	307	3.4	24		
3-35	738	" × "	46	37	23	30	25	34	41	26	40	302	3.4	41	343	3.4 3.47			
	x̄	358×OPEN									4.2		3.5	3.9		3.4	2.4		3.40
3-6	739	358×358			35		38	30	18	24	37	182	3.0	18	200	2.9	19		
	x̄	358×358											3.0	1.8		2.9			
1-27	769	359×356	40	46	33	38	33	34	30	34	34	322	3.6	38	360	3.6	28	37	3.4
3-2	769	" × "		54	29		36	24	29	32	44	248	3.6	32	280	3.5 3.1	24		
3-11	769	" × "	32	57	44	39	39	40	35	41	29	356	4.0	35	391	3.9 3.5	37	47	3.8
	x̄	359×356									3.6		3.7	3.5		3.7 3.4	3.0		3.60
3-30	770	359×362	39	34	25	29	29	34	42	39	57	328	3.6	40	368	3.7	30	40	3.67
	x̄	359×362											3.6	4.0		3.7 3.68			
2-35	921	359×OPEN	43		27	30	27	32	35	33	38	265	3.3	40	305	3.4			
2-11	921	" × "	39		38	41	25	38	19	27	31	258	3.2	27	285	3.2			
3-3	921	" × "			25		29	31	31	36	40	192	3.2	33	225	3.2	37		
3-14	921	" × "	38	47	29		28	28	31	32	38	271	3.4	41	312	3.5 3.3			
3-39	921	" × "	38	32	32	37	34	43	30	41	32	319	3.5	37	356	3.6 3.6	34		
	x̄	359×OPEN									3.6		3.3	3.6		3.4 3.34	3.6		
2-20	922	360×360	40	51	36	37	35	28	30	21	34	312	3.5	34	346	3.5 3.3	30	25	3.38
2-14	930	" × "	46		27	31	22	25	21	40	25	237	3.0	39	276	3.1	31		
	x̄	360×360											3.2	3.6		3.30			
2-42	924	360×OPEN	44	3.77 3.53 3.65	34	29	35	39	31	30	32	274	3.4	40	314	3.5	28		
3-27	924	" × "	47		38	17	21	32	31	27	30	243	3.0	40	283	3.1			
	x̄	360×OPEN									31		3.2	4.0		3.3			
2-4 1-42	925 925	362×OPEN	34	33	32	30	35	26	22	29	24	265	2.9	38	303	3.0 2.9	23		
	x̄	362×OPEN											2.9	40 3.9		3.0 2.93			
1-34	927	368×OPEN	34	4.19 3.07				30	29	28	31	152	3.0	34	186	3.1	24	41	
1-36	927	" × "	29	4.13 3.10	33	33	33	35	31	60	38	292	3.6	41?			30	44	3.67
2-15	927	" × "			28	33	35	44	22	38	33	233	3.3	39	272	3.4	39		
3-20	927	" × "	28	44	18	21	24	29	32	36	49	281	3.1	52	333	3.3 3.2	22		
	x̄	368×OPEN											3.2	4.2		3.4 3.20			
1-26	929	368×356	29		32	44	35		24	42	55	261	3.7	38	299	3.7	24	38	3.6
2-43	929	" × "	47	67	25	36	32	42	22	41	33	345	3.8	40	385	3.9	34	44	3.8
	x̄	368×356											3.8	3.9		3.8 3.6			3.65

[See correspondence with Pete Garrett, 1984]

May 8, 1984

Notes on Problem Analysis for Genetic Improvement of Sap-sugar Concentration in Sugar Maple (*Acer saccharum* Marsh.), Project NE-1401.

The following notes are items which Ron Wilkinson and I discussed to some extent, and which are mentioned in relation to the problem analysis.

1. Discussions with Ron and my own experience with progeny-testing of sugar maple for sap sweetness lead me to believe that the main reason for the negative results listed on page 4 is the failure to thin the progeny tests during the past 2½ decades, leading to competition and inhibition of crown development. In our experiments, full expression of crown phenotype at every age has been essential to expression of sap-sugar genotype. Thinning in our open-pollinated progeny test of Williamstown families, where family differences were barely significant at a 5' x 10' spacing after 20 years, led to large increases in sap sugar content during the subsequent 5 year period and still larger after 7 years. There was a tremendous increase in crown development. In the progeny tests at Proctor and Hopkins, it would appear best to thin within families first, if possible, because of the family x plantation interactions, then to test for 2 or 3 years before thinning by families. It should be noted that there are some families, e.g. 575 and 576, which are low performers in both plantations. These two families are also low performers in both our clonal seed orchard and O.P. progeny test, and their female parents/ortets are also below average, at least among our ortets. They certainly could be removed at this time, or soon. We removed 575 from our seed orchard in 1979.

   It should also be noted that some of our high-ranking families also rank high in your tests (583 in both of your tests, 640 and 545 in one or the other of them. This similarity of results between Ohio and New England plantations indicates that heritability differences are showing up, broad-sense as well as narrow-sense. I think that a few years after thinning, you will begin to see fairly large family differences in sap-sugar and that many of the negative results listed on page 4 will disappear.

2. A second reason for my considering the conclusions on page 4 as premature and overly pessimistic is the testing procedure, which is proposed to be tackled by more intensive sampling. Although you have as many tests on which to base results as we do, there seems to be somewhat less consistency from year to year than we have obtained. This may have something

to do with the testing technique. Certainly it doesn't seem to be the location, since Fred Taylor got pretty consistent individual tree results in Vermont 30 years ago. There may be some things about Bill Gabriel's mini-tapping procedure which lead to variability (Ron mentioned the diameter effect, for one). Testing based on sampling of total sap yield, as is being attempted, should be the best way if the manpower is available.

3. Going through a sexual generation of breeding takes a long time. Improved stock has then to be grown for 25-30 years before it can be tapped. This means several decades, 50 years or more here in Ohio, before the research pays off in improved production. For this reason, I think it is imperative to give first priority to utilizing material already on hand as soon as possible for supplying genetically-improved seed to nurseries. There is pretty good evidence of high heritability, though rather imprecise. We here also have evidence, also imprecise, of specific combining ability. For these reasons, collection and distribution of seed from your grafted clone bank (eliminating any known low-performing clones) should be a means of getting improved trees out right away. If I understood Ron correctly, this is already being done (or is it from the progeny tests?). After the progeny tests have been thinned and tests made after crowns develop, families can be rogued and conversion made to a seed orchard if more consistent test results are obtained.

4. The four tests established in 1983-84 will, hopefully, eventually provide a greater genetic gain from collected seed than the earlier plantings (the word eventually is significant and this is why utilization of the older tests is important).

5. Making a lot of tests or continuous testing in one year will not completely eliminate the need for testing more than one year, because sugar maple producers who tap a whole season get more (and sweeter, I believe) sap one year than another year. It will help, though, and I agree with Ron on his approach to testing.

6. After the initial efforts to get existing plantations and clone banks into use as mentioned above, the longer-term tests are important to an ongoing improvement program. I think the approaches outlined in the problem analysis are sound and that Ron has them well in mind. I hope it is clear from our results here and from yours in O.P. families when compared with ours, that (a) open-pollinated progeny testing and either collecting from the selected parents or seed orchard conversion appears to be more promising than the problem

analysis indicates; (b) clonal testing, even with unselected rootstocks, can give good information on ortet quality (give them room, and I think the crown effect will outweigh the rootstock effect, averaged over all ramets); (c) specific combining ability looks especially promising. I had, in fact, proposed to undertake controlled crossing in progeny test plantations 15 years ago (USDA, USFS Res. Pap WO-7, p. 14) as the best way to maximize gain, but had to cut back on field work and never got to it.

Enough. Maybe too much!

Howard

GABRIEL
77

OARDC
Ohio Agricultural Research and Development Center
WOOSTER, OHIO 44691
TELEPHONE (216) 264-1021

DEPARTMENT OF FORESTRY

November 7, 1977

Mr. William J. Gabriel
USFS NEFES
Burlington Research Center
Box 968
Federal Building
Burlington, Vermont 05402

Corrected Address
Mr. William J. Gabriel
Northeastern Forest Experiment Station
P. O. Box 968, 705 Spear Street
Burlington, Vermont 05401
(This address used on envelope)

Dear Bill:

This is in reply to your letter about the sugar maple program and the questions you asked.

First, a correction on your quote of the news release. It does not say that the selection program resulted in 30 of the best sugar maples in the northeast. It says branch cuttings and open-pollinated seeds were collected from about 30 of the best sugar maples in the northeast for which long-term records were available. I believe this to be true. Having at that time recently been in New Hampshire, I knew the work and the selections of Dunn and Eggert and was in communication with Fred Taylor, Jim Marvin and Bob Morrow, as well as Frank Cunningham.

The long-term records that these people had kept provided a basis for phenotypic selection. We had also had a maple syrup research project going here for several years before I arrived, and fairly extensive records were available for sugar bushes in various parts of northeastern Ohio, the major syrup-producing part of the state. Stevenson and Bartoo had also been making studies in Pennsylvania.

This, therefore, is the selection program that led to procurement of cuttings and seed for the program here. Ideally, it would have been better had plantations been available for selection, but they were rare. In any case, some degree of consistency had been observed in relative position of trees in rankings, as Fred Taylor and others noted. It seemed worth a gamble to select high-ranking trees in the wild, since a difference of so many years of program development was involved. So we did.

It is indeed difficult to appraise results in a maple syrup improvement program. It is certainly not like measuring height or DBH. We have found variation from tree to tree, ramet to ramet, minute to minute, hour to hour, day to day, week to week, year to year.

The fact that seedlings and small saplings often don't flow when large trees are running has made measurement during the first ten years difficult, irregular and, in our case, not easily subject to statistical analysis, because tree A will flow one time when tree B doesn't, and vice versa. The only thing that seems to give consistency is a lot of measurements on each tree, over a period of several years. Our results generally agree with Fred Taylor's for large trees with regard to relative ranking; it will vary some from year to year. But our three or four best Ohio roadside trees out of about 20 pretty consistently remained the three best from year to year and the lowest were also pretty consistent. Intermediate ones fluctuated quite a bit in their ranking. The ranking from day to day within years was somewhat more variable.

Here are rankings of nine high, medium, and low roadside trees, of those here at the OARDC, over a 4-year period, averaging about 5 measurements per year:

Tree No.	1955	1956	1957	1958	Cumulative Mean	Mean %
358	1	1	1	2	1	3.9
356	2	2	7	3	2	3.3
354	4	3	4	6	3	3.1
359	8	5	3	1	4	3.0
368	3	8	2	4	5	2.8
360	7	7	6	7	6	2.7
366	6	4	8	5	7	2.7
362	5	6	5	8	8	2.6
361	9	9	9	-	9	1.7

I list these nine because they are the ones we used in our 1955 crossing experiment.

Here are rankings of cross-pollinated progenies from these trees, as of March 1977:

Cross	Rank	Mean % (Forest-type trees)
358 x 356	1	2.9
359 x 356	2	2.8
368 x 356	3	2.7
360 x 360	4	2.5+
358 x 362	5	2.5-
359 x 362	6	2.4
358 x 358	7	2.3

It should be noted that in our experience, 2.9% is a very high cumulative average for young trees growing in a stand (7' x 10' spacing).

The results up to 1977, therefore, continue to show (as reported in "Genetics of Sugar Maple") that the progeny of the 2 highest-ranking control-pollinated families ranks highest in the progeny test, as it did in 1964.

The family 358 x 356 is the one seedling progeny in the seed orchard, which is otherwise clonal. Under these open-grown conditions, the cumulative average to date for all observations on all trees in this family is 4.8%. This is higher than the average of any clone in the 20-year-old orchard. The clone from tree 358 averages 3.2% and that from tree 356 4.3%, so far.

Thus family 358 x 356 averages highest in both the seed orchard and the control-pollinated progeny test, considerably higher than the average of either parent, and considerably higher than the average of either clone from the parents. In fact, on one mid-season test date, 5 of 9 trees of that family read over 6% (one 7.4%), and only one read under 4.4%. There were only 2 other readings of 6% or better in the orchard that day.

Of course, the effects of rootstocks must be considered. These are unknown (to us at least) and may have been one reason there were few such high readings among the grafts. If you have any results of studies on the effects of rootstock on graft sugar percent I'd appreciate having them. In comparing orchard clones, with 10 ramets per clone, we compare clones on the rationalization that rootstock effects will average out with 10 grafts per clone. We know some rootstocks tested higher than others before grafting. Of course the orchard was designed for seed production, not primarily for sugar testing.

Although the results suggest a heterosis effect, since the progeny mean is substantially higher than that of either parent under open-grown conditions, we don't have enough data to push that hypothesis very hard. We don't have very many progenies in our 2-parent test, of course, but nevertheless these are our results, and they are certainly indicative of a high breeding potential.

We also have a one-parent progeny test of 12 families from Williamstown, Massachusetts roadside trees, from seed sent by Frank Cunningham. These are all families from high-yield trees, and there is not a wide difference in progeny test means so far, ranging (under stand conditions) from 2.9% to 2.2%.

Here is a ranking of Williamstown parents and progenies so far (20 years old):

Tree No.	Female Parent Rank	Female Parent Mean %	O. P. Progeny Rank	O. P. Progeny Mean %
545	4	4.7	1	2.9
619	2	4.9	2	2.8
583	3	4.8	3	2.7
632	7	4.1	3	2.7
640	10	3.8	4	2.6
664	6	4.4	4	2.6
572	1	5.3	5	2.5
573	4	4.7	6	2.4
624	5	4.6	7	2.4
585	8	4.0	7	2.3
575	9	3.9	8	2.2

But who knows what the pollen parents were of these seedling progenies? About all the test shows so far is that there are significant differences among O.P. progenies at $p = <.05$.

It would have been nice to be able to progeny-test all seed orchard clones, but we could not cross the ortets in situ, as in the Proctor sugar bush or Bob Morrow's Van Auken tree, and our grafts didn't flower early the way yours did, either in the greenhouse, nursery, or field. In fact I guess nearly half the clones haven't flowered yet.

A clonal test with rooted cuttings would have been desirable, but that was also impossible because rooting techniques were not worked out at the time.

The full-sib progeny test of the 9 of about 20 of our roadside ortets which flowered in 1955 was designed as a study of sugar percent inheritance, involving the crossing of a number of "high","intermediate" and "low" average sugar content trees which produced male and/or female flowers. I also tested open-pollinated material from several of the trees. Results were a somewhat irregular design and limited number of progenies. Analysis by Namkoong using a least squares computer program gave a rather high general combining ability and a heritability around 60%. The standard error of this is, of course, fairly large. It does, however, indicate a pretty good breeding potential.

Actually, on-the-ground results are the best indication of what a sugar bush can yield. The one seedling family which is in both the full-sib progeny test and the orchard has averaged, as indicated 2.9% in the progeny test at close spacing with small crowns, and 4.8% in the orchard at wider spacing with larger crowns. Thus it is quite possible if not probable that some of the other full-sib families, if growing at wide spacing, would average over 4%. The seed orchard as a whole averages at present 3.7% on the basis of 175 sugar tests of 120 trees on 3 mid-season dates, 2 in 1964 and 1 in 1977. There are about 180 trees in the orchard.

The trees are still young and the crowns still have a lot of growth ahead. Also, except for the one C.P. family, they are grafted on rootstocks, which may be depressing sugar percent, since the one seedling family is the highest in the orchard. In addition, research by Moore et al (OAES Res. Bull. 718, 1951) showed sweetness of sap increases with tree size, and should be higher as the trees approach maturity. The wide spacing will favor high sugar percent. Stevenson and Bartoo (1940) found in Pennsylvania that "open-grown" trees averaged more than 1% higher than "forest grown" trees, and "roadside" trees 1.5% higher. The "roadside" trees had wider crowns than the "open-grown" trees.

So, it seems reasonable to expect that our seed orchard will reach a 4% average, unless the rootstocks hold it back. If we removed 6 clones, it would average 4% now. If the grafts from roadside trees reach their ortet means, it will average 4%. If the orchard were composed entirely of grafts from our best family, which of course would be too limited a genetic base, it would right now average 4.8%. If the orchard does reach 4%, seed from natural crossing should do at least as well, or better.

I wish I had a good correlation for all families between stand-condition sugar percent and open-condition sugar percent, but if the one family for which I do have data is a good indication, we should easily reach 4% or better in a seedling seed orchard.

These various factors indicate that even in Ohio, where sugar percent seems to average a little lower than in the Northeast, we can obtain an average sugar percentage of 4% and quite possibly higher, in open-grown plantations with good sugar bush management. The latter statement, quoted from the news release, is very important.

I've tried to give you the basis of my statements. We have no hard and fast proof, but will we ever get such proof? Your large-scale experiments should give better information than the limited research I was able to do with one technician. But a reliable demonstration of genetic gain that can be generalized is tough enough in some species like loblolly pine. In sugar maple, as you know, it's many times harder.

A few more observations:

1. Doubling average sugar yield of 2% in Ohio sugar bushes might not be possible in Vermont where the average is perhaps 2.5%. But maybe you can do better.

2. Another positive factor is the correlation between sugar content and sap yield. This presumably is due to the fact that both are correlated with tree size. Anyway, this should lead to more sap from the type of sugar bush we're working toward, as well as sap of higher sugar content, leading to an even higher return in terms of amount of syrup per tree tapped.

3. Optimum returns will depend on very full crowns, meaning roadside or open-grown trees spaced at least 40 feet apart and perhaps wider, with crown contact never permitted at any stage of growth. There is probably a point at which it is better to have more trees per unit of area instead of wider spacing, to get maximum yield, not per acre but per unit of time required for collection.

4. A sugar bush of improved selections should ideally either consist of rogued seedlings or rooted cuttings. Rooted cuttings only maintain the level of the selected ortets, which, however, could be well over 4%. Rogued seedlings could very well give a 5% bush, perhaps even better.

5. Progeny tests at close spacing will never give many high readings. If a clone or family in a stand averages 3%, this is excellent. We need good correlations between forest-grown and open-grown (30 x 30 and over) tests, because we can't do all our progeny testing at such wide spacing.

6. Regarding the fluctuation in year-to-year ranking, this could be expected. I think you'd need many times as many readings per year as you or I are taking to get a consistency in year-to-year ranking. After all, we are trying to measure the yearly output of sugar from a flow lasting several days, repeated several times, by only a few tests per year. Given the known variation, the sampling error is bound to be large. You might need 25 to 50 tests per year to show consistency. This doesn't mean heritability is low. It could still be quite high, in terms of total sugar yield per year.

7. What it all boils down to is that we need large trees with very big crowns and lots of small branches. Fastigiate forms seem to be particularly good, in my experience. It doesn't really matter whether the tree form is the result of environment or genetics as far as results are concerned, but it seems safe to say that there is evidence that the best trees have a genetic component that is partly responsible for their form and size. In any case, there is no such thing as a narrow- or small-crowned high-yield sugar tree.

That's all I have. My apologies for the rambling.

Sincerely,

Howard

Howard B. Kriebel
Professor
Forest Genetics

HBK:rs

cc: Bob Morrow

AC-4 age 3/11/77

All Measurements through 3/9/77 (sum in Col. 23)

	16	3	6	7	7	2	20	3	1	2	15	13	3
% over 2.58	3.6x3.4 75% 733	3.6 x self 0% 736	3.6 x2.6 33% 737	3.61 57% 738	2.6x3.4 57% 769	2.6 x2.6 50% 770	2.64 36% 921	2.49 66% 930 922	2.5 x3.4 0% 923	2.49 100% 924	2.59 7% 925	2.6 38% 927	2.6 x 3.4 66% 929
	2.54	2.40	2.44	2.82	2.47	2.84	2.58	1.68	1.46	3.02	2.35	2.43	2.78
	3.08	2.46	1.83	2.42	3.05	2.01	2.39	3.03		2.80	2.10	2.90	3.29
	3.76	1.90	2.79	2.87	2.37		2.07	2.80			2.40	2.95	1.98
	2.79		2.50	2.44	2.41		2.48				1.93	2.62	
	2.40		2.84	2.52	2.60		2.46				2.22	2.18	
	2.40		2.40	2.59	3.17		2.52				1.98	2.58	
	2.60			2.73	3.47		2.83				2.20	3.06	
	3.64						2.54				2.01	2.57	
	2.79						2.38				2.51	2.71	
	3.33						2.82				2.30	2.13	
	2.32						2.52				1.90	2.34	
	3.19						2.24				2.66	2.43	
	3.07						2.78				2.06	2.02	
	2.95						2.30				2.01		
	2.75						2.48				2.33		
	2.87						2.89						
							3.41						
Σ =	4648	676	1480				2.31						
x̄ =	2.90	2.25					2.75						
							2.56						
				1839	1954		5131	751		582	3296	3292	805
x̄ =	2.90	2.25	2.47	2.63	2.79	2.42	2.57	2.50		2.91	2.20	2.53	2.68

RANKING

1	924	(360 x OPEN)	8xOP	2.91
2	733	(358 x 356)	6x4	2.90
3	769	(359 x 356)	7x4	2.79
4	929	(368 x 356)	16x4	2.68
5	738	(358 x OPEN)	6 x op	2.63
6	921	(359 x OPEN)	7 x op	2.57
7	927	(368 x OPEN)	16 xop	2.53
8	930 922	(360 x 360)	8 x 8	2.50
9	737	(358 x 362)	6 x 10	2.47
10	770	(359 x 362)	7 x 10	2.42
11	736	(358 x 358)	6 x 6	2.25
12	925	(362 x OPEN)	10 x op	2.20

Parent Rank

1	358	3.63
2	356	3.43
3	359	2.64
4	362	2.59
5	368	2.56
6	360	2.49

	356	358	360	362	OPEN
358	2.90	2.25		2.47	2.63
359	2.79			2.42	2.57
360			2.50		2.91
362					2.20
368	2.68				2.5

AC-4

Mar. 1, 1973 Meas.
(Age 18 from seed) 17

	738	733	736	739 737	769	921	770	924	930 922	923	926	17 925	929	92[illegible]
	358 × OPEN	358 × 356	358 × SELF	358 × 362	359 × 356	359 × OPEN	359 × 362	360 × OPEN	360 × SELF (UN)	360 × 356	362 × SELF (UN)	362 × OPEN	368 × 356	368 + OPEN
	3.4	2.4	2.2	2.4	2.9	1.9	4.2	3.1	1.0	1.6	2.6	2.2	2.4	2.8
	3.7	2.4	2.8	2.5	3.5	2.5	3.4	3.1	3.0			2.3	2.4	3.2
	2.1	2.6	2.2	1.8	2.9	3.1			2.1			2.4	2.2	2.0
	3.0	3.1		2.2	3.0	3.1						3.1		3.0
	2.2	3.8		2.5	3.4	2.0						2.4		2.9
	2.4	2.3		2.5	2.4	2.2						2.5		3.1
	4.1	2.8			2.9	2.0						2.2		2.2
		3.3				2.1						2.1		2.5
		2.9				3.1						1.7		2.8
		2.6				1.4						2.1		2.2
		2.8				3.3						2.8		2.8
		2.9				2.3						1.9		2.3
		3.3				2.6						3.0		2.6
		2.9				2.9						2.5		2.3
		3.1				3.1						2.2		
		2.7				2.3						2.4		
		3.3				3.5								
		3.8				2.5								
						2.2								
						2.5								
						3.0								
						3.0								
n =	7	18	3	6	7	22	2	2	3	1	1	16	14	
$\bar{x}$	3.0	2.9	2.4	2.3	3.0	2.6						2.4	2.6	

Highest reading

	358	356	362	OPEN
358		3.8	2.5	3.7
359		3.5		3.5
368				3.2
362				3.1

Mean

	358	356	360	362	OPEN
358		2.9		2.3	3.0
359		3.0			2.6
368					2.6
360					
362					2.4

RHM MEAN 2nd rerun

11/24/67

1	11612.	10960.		
TREAT	N	MEAN	RANK	ST.DEV.
358000.	7.	.25885714E 01	5	.36126767E 00
358356.	16.	.28256250E 01	2	.53673084E 00
358358.	4.	.21800000E 01		.40898247E 00
358362.	4.	.22725000E 01		.42074339E 00
359000.	20.	.24815000E 01	6	.32379818E 00
359356.	7.	.27371429E 01	3	.18909565E 00
359362.	2.	.21500000E 01		.60811183E 00
360000.	2.	.28650000E 01	1	.27577164E 00
360360.	3.	.23700000E 01		.88153275E 00
362000.	14.	.22500000E 01		.27453457E 00
368000.	13.	.23138461E 01		.26392991E 00
368356.	3.	.26600000E 01	4	.72380937E 00
TOTAL	95.	.24908421E 01		

1 Std. Error $= .1465$

$\left(SE = \frac{SD}{\sqrt{N}} \right.$

avg. $N = 7.197$ $\frac{.3989}{2.722} = .1465$

$\sqrt{N} = 2.722$

go $\pm .1465$ from the mean, which is 2.491

ANALYSIS OF VARIANCE

SOURCE	DF	MS	F
TOTAL	94.		
TREAT	11.	.42954636E 00	.26994384E 01
ERROR	83.	.15912434E 00	SD= .39890392E 00

$$g^2 = \frac{2\sigma_f^2}{\sigma_f^2 + \sigma_e^2}$$

Model: $\frac{\sigma_i^2 + 7.917\,\sigma_f^2}{\sigma_i^2}$

$$= \frac{.15912 + 7.917(.03416)}{.15912}$$

$$g^2 = \frac{2(.03416)}{.03416 + .15912}$$

Derivation:

$7.917(x) + .15912 = .42955$

$x = .03416$

$$= \frac{.06832}{.19328} = .353$$

Using harm. mean

$x = .06114$

or if use $\frac{3(.03416)}{.03416 + .15912}$ $\qquad \frac{3(.06114)}{.06114 + .15912}$

$$= \frac{.10248}{.19328} = .530 \qquad = \frac{.18342}{.22026} = .833$$

(see 301.6 calculations)

$$4.423x + .57224 = 1.75969$$

$$x = .26847$$

352.7

RHM MAX (Family mean of ~~maximums~~ for ~~each~~ member of fam)

2nd rerun 11/24/67

2	12011.	10960.	
TREAT	N	MEAN	ST.DEV.
358000.	7.	.40142857E 01	.11696566E 01
358356.	16.	.41625000E 01	.90691786E 00
358358.	4.	.31750000E 01	.97425185E 00
358362.	4.	.38250000E 01	.66520673E 00
359000.	20.	.33950000E 01	.74302015E 00
359356.	7.	.40000000E 01	.34641016E 00
359362.	2.	.34000000E 01	.70710678E 00
360000.	2.	.45500000E 01	.21213203E 00
360360.	3.	.34333333E 01	.15307950E 01
362000.	14.	.30785714E 01	.42819657E 00
368000.	13.	.30230769E 01	.30318861E 00
368356.	3.	.38666667E 01	.11930354E 01
TOTAL	95.	.35663158E 01	

ANALYSIS OF VARIANCE

SOURCE	DF	MS	F
TOTAL	94.		
TREAT	11.	.17596909E 01	.30751132E 01
ERROR	83.	.57223614E 00	SD= .75646291E 00

Model:

$$g^2 \quad \frac{2\sigma_f^2}{\sigma^2 + \sigma_e^2} \qquad \frac{\sigma_i^2 + 7.917\,\sigma_f^2}{\sigma_i^2}$$

$$= \frac{.57224 + 7.197(.16499)}{.57224}$$

$g^2 =$

Using harmonic mean:

$$\frac{3(.26847)}{.84071} \; .958$$

$=$

Derivation:

$7.197x + .57224 = 1.75969$

$x = .16499$

Wright's Method:

$$g^2 = \frac{3(.16499)}{.16499 + .57224} = \frac{.49497}{.73723} = .671$$

$$g^2 = \frac{.16499}{.16499 + \frac{.57224}{3}} = \frac{.16499}{.35574} = .464$$

THE OHIO STATE UNIVERSITY
COLUMBUS, OHIO 43210

COLLEGE OF AGRICULTURE AND HOME ECONOMICS
Resident Instruction—Research—Extension

DEPARTMENT OF DAIRY SCIENCE
735 STADIUM DRIVE

March 5, 1968

Dr. Howard B. Kriebel
Department of Forestry
Ohio Agricultural Research
and Development Center
Wooster, Ohio 44691

Dear Howard:

I am enclosing a copy of the report I referred to in our discussion over the phone recently. You will note that with an irregular mating system and unequal frequencies, the exact expectations of the mean squares with respect to genic variance become messy algebraically. The application of these procedures to your particular problem may not be easy to work out. I expect that some approximation procedure that is based on the principles described in this paper will be satisfactory.

For the estimation of heritability from the variance components obtained from simply a between and within family analysis of variance when some of the families are full-sibs, some are half-sibs, some are inbred and others are outbred the basic problem is to estimate two constants; namely, the percentage of the genic variance (R) expected to be in the between family variance component (σ_f^2) and the percentage of the genic variance (S) expected to be in the within family variance component (σ_e^2). With estimates of R, S and the variance components the estimate of heritability is

$$g^2 = \frac{\frac{1}{R}\sigma_f^2}{\frac{1-S}{R}\sigma_f^2 + \sigma_e^2}$$

If all families were full-sib families with no relationship among families and no relationship of mates, R = 1/2 and S = 1/2. However, with the problem you described to me over the phone you will need to compute both R and S from the numbers of different kinds of relatives, from the relationship among families and from the amount of inbreeding.

If I can be of further assistance to you on this problem, please let me know.

Sincerely yours,

Walt

Walter R. Harvey
Professor

WRH:am

Enclosure

Dec. 5, 1966

301.6 HIGHEST VALUE

13016 11011. 10660.

TREAT	SUM	N	Rank	MEAN	STD DEV
358000.	.31000000E 02	8.	4	.38750000E 01	.11523268E 01
358356.	.66600000E 02	16.	2	.41625000E 01	.90691786E 00
358358.	.98000000E 01	3.		.32666666E 01	.11718931E 01
358362.	.15300000E 02	4.	6	.38250000E 01	.66520673E 00
359000.	.67900000E 02	20.		.33950000E 01	.74302015E 00
359356.	.28000000E 02	7.	3	.40000000E 01	.34641016E 00
359362.	.68000000E 01	2.		.34000000E 01	.70710678E 00
360000.	.13100000E 02	3.	1	.43666667E 01	.35118870E 00
360356.	.18000000E 01	1.		.18000000E 01	.00000000E-50
360360.	.63000000E 01	2.		.31500000E 01	.20506096E 01
362000.	.46300000E 02	15.		.30866666E 01	.41380982E 00
368000.	.39300000E 02	13.		.30230769E 01	.30318861E 00
368356.	.11600000E 02	3.	5	.38666667E 01	.11930354E 01
TOTAL	.34380000E 03	97.	7	.35443299E 01	

ANALYSIS OF VARIANCE

SOURCE	SSQ	DF	MS	F
TOTAL	.70059400E 02	96.		
TREAT	.21844400E 02	12.	.18203666E 01	.31714361E 01
ERROR	.48215000E 02	84.	.57398810E 00	

$P < 0.1\%$ due to chance

Dec. 5, 1966 301.6 MEAN

23016 11512. 10660.

TREAT		SUM	N	N		MEAN	STD DEV
358000.	×	.20100000E 02	7	8.	5	.25125000E 01	.39769874E 00
358356.	OK	.45210000E 02		16.	2	.28256250E 01	.53673084E 00
358358.	×	.67400000E 01	4	3.	10	.22466666E 01	.47353300E 00
358362.		.90900000E 01		4.	7	.22725000E 01	.42074339E 00
359000.		.49630000E 02		20.	6	.24815000E 01	.32379818E 00
359356.		.19160000E 02		7.	3	.27371429E 01	.18909565E 00
359362.		.43000000E 01		2.	11	.21500000E 01	.60811183E 00
360000.		~~.88000000E 01~~		2 ~~3.~~	1 2.86	.29333333E 01	.22810852E 00
360356.		.13000000E 01		1.	12	.13000000E 01	.00000000E-50
360360.		.40400000E 01		2.	7 2.37	~~.20200000E 01~~	.90509668E 00
362000.		.33820000E 02		15.	9	.22546666E 01	.26516490E 00
368000.		.30080000E 02		13.	8	.23138461E 01	.26392991E 00
368356.		.79800000E 01		3.	4	.26600000E 01	.72380937E 00
TOTAL		.24025000E 03		97.		.24768041E 01	

ANALYSIS OF VARIANCE

SOURCE	SSQ	DF	MS	F
TOTAL	.19360500E 02	96.		
~~TREAT~~ Families	.65848600E 01	12.	.54873833E 00	.36079617E 01
ERROR	.12775640E 02	84.	.15209095E 00	

P < 0.1% due to chance.

Model:

$$g^2 = \frac{2(\sigma^2_f)}{\sigma^2_f + \sigma^2_e}$$

$$\sigma^2_i + 7.46\,\sigma^2_f$$

$$\sigma^2_i$$

$$= \frac{.15209 + 7.46(.05317)}{.15209}$$

[7.46(x) + .15209 - .54874
x = .05317]

$$g^2 = \frac{2(.05317)}{.05317 + .15209}$$

$$= \frac{.10634}{.20526} = .513$$

(actually a combination of full-sib & open-poll (half-sib fams., so somewhere between 50% and 100%)

MEAN RERUN 301.6

23016 11512. 10660.

TREAT	SUM	N	MEAN	STD DEV
358000.	X .20100000E 02	7 ~~8.~~	.25125000E 01	.39769874E 00
358356.	.45210000E 02	16.	.28256250E 01	.53673084E 00
358358.	X .67400000E 01	4 ~~3.~~	.22466666E 01	.47353300E 00
358362.	.90900000E 01	4.	.22725000E 01	.42074339E 00
359000.	.49630000E 02	20.	.24815000E 01	.32379818E 00
359356.	.19160000E 02	7.	.27371429E 01	.18909565E 00
359362.	.43000000E 01	2.	.21500000E 01	.60811183E 00
360000.	.57300000E 01	2.	.28650000E 01	.27577164E 00
360356.	.13000000E 01	1.	.13000000E 01	.00000000E-50
360360.	.71100000E 01	3.	.23700000E 01	.88153275E 00
362000.	X .33820000E 02	15.	.22546666E 01	.26516490E 00
368000.	.30080000E 02	13.	.23138461E 01	.26392991E 00
368356.	.79800000E 01	3.	.26600000E 01	.72380937E 00
TOTAL	.24025000E 03	97.	.24768041E 01	

ANALYSIS OF VARIANCE

SOURCE	SSQ	DF	MS	F
TOTAL	.19360500E 02	96.		
TREAT	.58778800E 01	12.	.48982333E 00	.30517184E 01
ERROR	.13482620E 02	84.	.16050738E 00	

HIGHEST VALUE RERUN 301.6

13016 11011. 10660.

TREAT	SUM	N	MEAN	STD DEV
358000.	.31000000E 02	8.	.38750000E 01	.11523268E 01
358356.	.66600000E 02	16.	.41625000E 01	.90691786E 00
358358.	.98000000E 01	3.	.32666666E 01	.11718931E 01
358362.	.15300000E 02	4.	.38250000E 01	.66520673E 00
359000.	.67900000E 02	20.	.33950000E 01	.74302015E 00
359356.	.28000000E 02	7.	.40000000E 01	.34641016E 00
359362.	.68000000E 01	2.	.34000000E 01	.70710678E 00
360000.	.91000000E 01	2.	.45500000E 01	.21213203E 00
360356.	.18000000E 01	1.	.18000000E 01	.00000000E-50
360360.	.10300000E 02	3.	.34333333E 01	.15307950E 01
362000.	.46300000E 02	15.	.30866666E 01	.41380982E 00
368000.	.39300000E 02	13.	.30230769E 01	.30318861E 00
368356.	.11600000E 02	3.	.38666667E 01	.11930354E 01
TOTAL	.34380000E 03	97.	.35443299E 01	

ANALYSIS OF VARIANCE

SOURCE	SSQ	DF	MS	F
TOTAL	.70059400E 02	96.		
TREAT	.21564400E 02	12.	.17970333E 01	.31127084E 01
ERROR	.48495000E 02	84.	.57732143E 00	

Harmonic Mean:
(Recipr. of arithm. mean of reciprocals)

N	Recipr.
7	.1429
16	.0625
4	.2500
4	.2500
20	.0500
7	.1429
2	.5000
2	.5000
3	.3333
14	.0714
13	.0769
3	.3333
	2.7132

mean = .2261

$$H = \frac{1}{.2261} = 4.423$$

$$4.423x + .15912 = .42955$$

$$x = .06114$$

SUGAR MAPLE

I-O 2 PARENT PROGENY TEST
SUGAR CONTENT

RANK OF ♀ PARENTS (BASED ON MEAN) HIGH TO LOW		Based on Max.	Based on highest	RANK OF PROGENIES (BASED ON FAMILY MEAN OF INDIVIDUAL TREE MEANS)*		
358	(3.9)	6.1	$\boxed{1}$	1	358 X 356	1 7.4
356	(3.3)	4.9	$\boxed{4}$	3	368 X 356	5
			$\boxed{3}$	2	359 X 356	5
359	(3.0)	4.3	$\boxed{2}$	4	358 X OPEN	2 6.
368	(2.8)	3.9	$\boxed{7}$	5	359 X OPEN	3
			$\boxed{6}$	6	360 X SELF	6
360	(2.7)	4.0	$\boxed{10}$	7	368 X OPEN	
			$\boxed{5}$	8	358 X 362	4
362	(2.6)	3.8	$\boxed{9}$	9	362 X OPEN	
			$\boxed{8}$	10	358 X SELF	6

HIGH — LOW

*EXCLUDING I-O 2 TREE PROGENIES

	MEAN OF TREE MEANS		HIGHEST TREE MEANS		HIGHEST READING		NO OF READINGS 5.0 & +
✓ 358 X 356	~~2.80~~	2.83	3.86	4.16	✓ 7.4	1	4 (+5
✓ 368 X 356	~~2.80~~	2.66	3.21	3.87	✓ 4.7	5	0
✓ 359 X 356	2.74	2.74	2.98	4.00	✓ 4.4	7	0
✓ 358 X OPEN	2.59	2.59	2.71	4.01	✓ 6.3	2	1
✓ 359 X OPEN	2.48	2.	3.00	3.40	✓ 5.0	3	1
✓ 360 X SELF	2.37		3.07	3.43	✓ 4.6	6	0
✓ 368 X OPEN	2.31		2.85	3.02	3.7	8	0
✓ 358 X 362	2.27		2.84	3.82	✓ 4.8	4	0
✓ 362 X OPEN	2.25		2.80	3.08	3.5	9	0
✓ 358 X SELF	2.18		2.66	3.18	4.6	6	0
360 X OPEN	2.86			4.55			
359 X 362	2.15			3.40			

Double grafts

~~Western south~~

East	2.3
West	2.2
~~Northern~~	
361	3.4
Other	1.8

South	2.3
North	2.6

East	2.6
West	2.6

2

OPEN = O
SELF = DITTO ♀

H. KRIEBLEL
FORESTRY
S 286
SUGAR MAPLE.

1 WAY ANOVA
♀♂ = FAMILY
(1) HIGHEST VALUE
(2) MEAN

301.6 ✓ P (1)

Row 1 AC-4

Acc. No. ♀ ♂	3/16/64	3/23/64	3/28/65	3/31/65	3/4/66	3/10/66	1964-65 Σ	1964-65 $\bar{x}$	3/1-3/2 66	1964-5-6 Σ	1964-5-6 $\bar{x}$	
362 × OPEN	—	3.0	1.6	2.0	–	2.1	6.6	2.20	2.3	11.0	2.20	
~~dead~~												
358×356	4.6	2.0	1.5	1.6	3.1	2.5	9.7	2.42	3.2	18.5	2.64	
358×OPEN	4.2	1.3	1.2	1.4	2.9	3.3	8.1	2.02	2.0	16.3	2.33	
359×356	4.4	1.4	2.2	2.0	2.7	1.3	10.0	2.50	3.0	17.0	2.43	
358×356	4.6	3.1	2.3	2.8	3.5	2.4	12.8	3.20	3.4	22.1	3.16	
362×OPEN	—	2.1	1.2	1.7	—	2.2	5.0	1.67	3.3	10.5	2.10	
358×SELF	—	2.8	1.8	2.2	2.3	2.5	6.8	2.27	2.5	14.1	2.35	
~~358×356~~	—	—	—	1.9	—	-			2.7			
362×OPEN	3.3	2.1	1.9	2.3	2.9	3.0	9.6	2.40	3.4	18.9	2.70	
358×356	5.0	4.9	1.6	3.6	3.9	3.5	15.1	3.78	4.5	27.0	3.86	
358×self	4.6	1.9	1.9	1.8	2.7	2.6	10.2	2.55	3.1	18.6	2.66	
368×OPEN	3.0	2.0	2.5	3.1	1.9	2.6	10.6	2.65	2.6	17.1	2.44	
~~dead~~												
359×OPEN	3.1	2.1	1.1	2.1	2.0	2.6	8.4	2.10	2.4	15.4	2.20	
368×OPEN	2.3	2.3	1.7	1.9	2.8	3.0	8.2	2.05	2.4	16.4	2.34	
358×OPEN	—	3.0	1.9	1.4	–	-	6.3	2.10	2.3	8.6	2.15	
362×OPEN	2.0	2.0	1.5	1.9	1.6	2.5	7.4	1.85	2.4	13.9	1.98	
359×OPEN	4.4	2.7	2.0	1.8	2.8	3.4	10.9	2.72	3.1	20.2	2.88	
359×OPEN	2.6	1.2	1.5	1.9	3.3	3.2	7.2	1.80	3.4	17.1	2.44	
~~358×362~~					-				1.4			
359×OPEN	—	1.0	1.3	1.8	2.1		4.1	1.37	2.9	9.1	1.82	
358×OPEN	6.3	3.2	2.1	2.6	2.9	3.1	14.2	3.55	2.6	22.8	3.26	
368×356	2.9	2.2	2.0	2.3	4.4	3.5	9.4	2.35	3.2	20.5	2.93	
359×356	4.0	2.1	1.7	1.9	3.8	3.3	9.7	2.42	3.3	20.1	2.87	
~~dead~~												
~~dead~~												
358×356	4.0	2.2	2.1	1.1	3.4	3.1	9.4	2.35	3.2	19.1	2.73	
~~dead~~												
358×356	2.2	—	1.2	1.3	-		4.7	1.57	2.8	7.5	1.88	
362×OPEN	3.6	2.1	1.9	2.0	2.4	2.5	9.6	2.40	2.5	17.0	2.43	
~~368×OPEN~~	3.4	2.3	—	—	-							
~~358×356~~	—	—	1.9	2.0	–	1.4						
368×OPEN	2.9	2.3	1.8	1.6	3.3	3.3	8.6	2.15	3.3	18.5	2.64	

P ✓ (2)

Row 1 AC-4

Acc. No.	3/16/64	3/23/64	3/28/65	3/31/65	3/4/66	3/10/66	1964-65 Σ	1964-65 $\bar{x}$	3/1 - 3/2 66	1964-5-6 Σ	1964-5-6 $\bar{x}$	
368×OPEN	2.8	2.4	1.8	1.6	3.7	2.5	8.6	2.15	3.1	17.9	2.56	
~~dead~~												
358×356	1.9	2.5	1.5	1.1	—	2.1	7.0	1.75	2.5	11.6	1.93	
~~dead~~												
359×OPEN	2.7	2.9	2.2	1.9	2.2	3.5	9.7	2.42	2.8	18.2	2.60	
362×OPEN	—	2.1	1.7	0.8	2.7	1.9	4.6	1.53	2.4	11.6	1.93	
358×356	4.8	3.2	2.0	1.5	3.0	2.5	11.5	2.88	3.0	20.0	2.86	
~~362×OPEN~~	—	~~2.1~~	—	—	-	2.3						
359×356	3.6	2.8	1.9	—	2.8	-	8.3	2.77	3.0	14.1	2.82	
Row 2												
~~358×356~~			1.8	1.3	—	3.1			3.6			
~~3 dead~~ dead												
~~dead~~												
362×OPEN	3.4	1.7	2.0	2.8	3.0	3.5	9.9	2.48	3.2	19.6	2.80	
~~359×OPEN~~			1.4	2.1	2.7	1.6			3.7	[illegible]		
368×356	2.5	1.7	1.7	1.5	1.8	1.6	7.4	1.85	2.1	12.9	1.84	
~~dead~~												
~~35 dead~~												
359×OPEN		2.3	1.8	1.8	2.8	3.4	5.9	1.97	2.8	14.9	2.48	
~~36 dead~~												
359×OPEN	3.9	2.4	1.7	1.9	4.1	2.5	9.9	2.48	3.8	20.3	2.90	
358×362	3.4	1.0	1.7	1.4	—	1.4	7.5	1.88	2.2	11.1	1.85	
358×356	3.8	1.2	1.9	2.0	2.9	2.4	8.9	2.22	2.3	16.5	2.36	
360×self	4.6	2.0	1.7	2.3	3.1	2.2	10.6	2.65	2.7	18.6	2.66	
368×OPEN		3.2	2.0	2.3	3.3	3.5	7.5	2.50	2.8	17.1	2.85	
368×OPEN		1.5	1.1	2.1	3.2	2.4	4.7	1.57	3.3	13.6	2.27	
368×OPEN	2.6	1.2	1.9	1.8	2.1	2.5	7.5	1.88	2.7	14.8	2.11	
359×OPEN	2.8	3.1	1.9	1.9	2.3	2.5	9.7	2.42	2.6	17.1	2.44	
368×OPEN			1.2		—							
360×UNP.	4.0	2.3	2.0	2.4	3.7	3.5	10.7	2.68	3.6	21.5	3.07	✓
~~dead~~												
362×OPEN	2.1	1.6	2.0	1.9	1.9	2.0	7.6	1.90	1.8	13.3	1.90	
358×OPEN	3.6	2.5	1.8	1.8	3.5	2.5	9.7	2.42	3.3	19.0	2.71	

✓ P ✓

Row 2 AC-4

Acc. No.	3/16/64	3/23/64	3/28/65	3/31/65	3/4/65	3/10/65	Σ	$\bar{x}$	3/1-3/2 66	1964-5-6 Σ	1964-5-6 $\bar{x}$	
358x356	4.1	2.8	2.1	2.0	3.5	3.6	11.0	2.75	3.3	21.4	3.06	
~~dead~~												
359xOPEN	2.8	2.7	2.3	2.0	2.7	2.7	9.8	2.45	2.4	17.6	2.51	
358x356	4.0	2.3	1.9	2.0	2.9	3.6	10.2	2.55	3.2	19.9	2.84	
362xOPEN	3.5	1.8	2.0	2.5	2.4	2.4	9.8	2.45	2.5	17.1	2.44	
~~360xself~~				0.9	-	1.3			1.8			
358x356	6.4	4.4	1.7	1.7	3.6	5.0	14.2	3.55	3.6	26.4	3.77	
358x362	3.7	0.8	1.5	1.0	3.0	-	7.0	1.75	2.6	12.6	2.10	
362xOPEN	1.8	0.9	2.1	2.0	2.0	2.3	6.8	1.70	3.3	14.4	2.06	
359x356	3.8	2.1	2.0	1.6	2.9	2.2	9.5	2.38	3.3	17.9	2.56	
dead 359XOPEN	4.3	1.6	2.5 dead	2.6	3.0	2.7	11.0	2.75	2.7	19.8	2.83	
360xself	1.6	1.0	1.3	1.2	-	1.5	5.1	1.28	1.7	8.3	1.38	
359xOPEN	3.4	1.7	2.2	2.0	2.6	2.9	9.3	2.32	2.7	17.5	2.50	
359xOPEN		1.6	1.3	1.6	-		4.5	1.50	2.7	7.2	1.80	
~~dead~~												
362xOPEN	3.0	2.4	1.9	1.8	2.5	2.2	9.1	2.28	2.4	16.2	2.31	
359x356	4.2	2.8	2.1	1.9	3.2	3.3	11.0	2.75	3.4	20.9	2.98	
360xOPEN	4.4	2.2	2.6	2.4	2.9	3.5	11.6	2.90	3.4	21.4	3.06	
368x356	4.7	3.5	2.8	2.2	3.6	3.2	13.2	3.30	2.5	22.5	3.21	
362xOPEN	2.3	1.3	1.8	2.0	—	2.3	7.4	1.85	3.2	12.9	2.15	
Row 3												
359x356		2.7	2.5	2.3	-	3.6	7.5	2.50	2.9	14.0	2.80	
359xOPEN		2.9	2.1	2.3	-	2.9	7.3	2.43	2.5	12.7	2.54	
~~359xOPEN~~						[illegible].2			3.4			
359xOPEN		2.6	2.0	1.6	-	2.4	6.2	2.07	2.9	11.5	2.30	
~~358x unp.~~			3.0	3.0	-	3.8			3.5			
~~36[illegible] dead~~												
~~362xOPEN~~			1.8		-	3.0			2.0			
~~dead~~												
3[illegible]8(xOPEN)		2.4	2.0	1.6		3.0	6.0	2.00	2.9	11.9	2.38	
359x356	3.2	2.9	2.2	2.3	3.9	3.9	10.6	2.65	4.4	18.9	2.70	
~~359xOPEN~~				0.9								
359xOPEN	2.6		2.1	1.6			6.3	2.10	2.6	8.9	2.22	

Row 3 AC-4 See corrections

Acc. No.	3/16/64	3/23/64	3/28/65	3/31/65	3/4/66	3/10/66	64-65 Σ	64-65 $\overline{x}$	3/1/66 -3/2	1964-5-6 Σ	1964-5-6 $\overline{x}$	
359xOPEN	3.8	1.4	2.2	2.1		2.8	9.5	2.38	2.9	15.2	2.53	
362 unp	3.0	2.5	1.2	1.6		2.4	8.3	2.08	3.2	13.9	2.32	
~~360 unp~~												
362xOPEN	2.8	2.5	1.8	1.6		1.8	8.7	2.18	2.2	12.7	2.12	
368xOPEN	2.0	2.2	1.9	1.7	3.0	2.7	7.8	1.95	3.3	16.8	2.40	
358x356	5.1	2.7	2.5	2.5	3.0	3.6	12.8	3.20	3.1	22.5	3.21	
368xOPEN	2.8	2.2	2.6	1.9	2.1	2.4	9.5	2.38	1.8	15.8	2.26	
~~3 dead~~												
358 unp	2.9	1.7	1.7	1.3			7.6	1.90	2.3	9.9	1.98	
358x362	4.8	2.7	1.8	1.7	3.5	2.8	11.0	2.75	2.6	19.9	2.84	
358x356	4.8	2.6	2.0	2.2	2.9	2.5	11.6	2.90	2.5	19.5	2.78	
358x362	3.4	2.1	1.9	2.0	-	2.5	9.4	2.35	2.4	14.3	2.30	
359xOPEN	5.0	3.6	2.8	1.9	3.0	2.7	13.3	3.32	2.0	21.0	3.00	
360xOPEN	4.7	2.5		1.4	1.7	2.1	8.6	2.87	3.8	16.2	2.67	
368xOPEN	2.7	1.4	1.8	1.5	-	1.7	7.4	1.85	3.0	12.1	2.02	
360x356	1.8	1.2		0.9	-	1.3	3.9	1.30		5.2	1.30	
359x362	3.9	2.3	2.1	1.5	2.9	2.9	9.8	2.45	2.5	18.1	2.58	
~~3 dead~~												
368xOPEN	2.2	2.5	1.4	1.9	1.8	2.5	8.0	2.00	2.1	14.4	2.06	
358xOPEN	3.4	2.5	2.0	1.6	3.2	3.2	9.5	2.38	3.1	19.0	2.71	
368xOPEN	2.7	1.9	1.5	1.3	1.9	3.2	7.4	1.85	2.9	15.4	2.20	
358xOPEN	4.6	2.5	1.7	1.5	3.0	2.5	10.3	2.58	2.3	18.1	2.58	
358x356	2.8	2.1	1.8	1.6	3.7	2.1	8.3	2.08	3.7	17.8	2.54	
359xOPEN	3.7	2.1	2.0	1.8	2.6	2.5	9.6	2.40	1.9	16.6	2.37	
358x358	2.1	1.7	1.6	1.4		1.2	6.8	1.70	2.4	10.4	1.73	
359xOPEN	3.8	2.4	1.9	1.6	3.7	3.4	9.7	2.42	3.2	20.0	2.86	
358x356	4.0	2.6	2.0	1.4	3.7	3.3	10.0	2.50	2.4	19.4	2.77	
362xOPEN	2.9	1.9	2.0	1.7	3.2	2.5	8.5	2.12	2.5	16.7	2.38	
358x356	3.9	2.5	2.5	3.6	-	2.6	12.5	3.12	1.8	16.9	2.82	
359xOPEN	3.2	1.4	1.7	1.8	3.1	3.1	8.1	2.02	2.6	16.9	2.41	
368xOPEN	2.6	1.4	1.6	1.3	2.4	2.6	6.9	1.72	1.6	13.5	1.93	
359x362	2.9	1.6	1.5	1.2		2.5	7.2	1.80	0.6	10.3	1.72	

Sept. 1966

Means of Tree Means
(all data on sheet)

	356	358	359	360	362	OPEN
358	2.80	2.18			2.27	2.59
359	2.74				2.15	2.48
360	1.30			2.37		2.86
362					2.32	2.25
368	2.80					2.31

Highest Tree Means

	356	358	359	360	362	OPEN
358	3.86	2.66			2.84	2.71
359	2.98				2.58	3.00
360	1.30			3.07		3.06
362					2.32	2.80
368	3.21					2.85

Sept. 1966

	358	356	360	362	OPEN
358	2.18	2.83		2.27	2.59
359		2.74		2.15	2.48
368		2.66			2.31
360		1.30	2.37		2.86
362				2.32	2.25

Mean of tree mean

	358	356	360	362	OPEN
358	2.66	3.86		2.84	2.71
359		2.98		2.58	3.00
368		3.21			2.85
360		1.30	3.07		3.06
362				2.32	2.80

Highest tree mean

	358	356	360	362	OPEN
358	4.6	7.4		4.8	6.3
359		4.4		3.9	5.0
360		1.8	4.6		4.7
368		4.7			3.7
362				3.0	3.5

Highest reading

1- or 2-tree progenies

AC-4

Totalization and Averaging of Tree Means

Sept., 1966
(age 10)

358 x OPEN	358 x 356	358 x SELF(UN)	358 x 362	359 x 356	359 x OPEN	359 x 362	360 x OPEN	360 x SELF(UN)	360 x 356	362 x SELF(UN)	362 x OPEN	368 x 356	368 x OPEN
2.33	2.64	2.35	1.85	2.43	2.20	2.58	3.06	2.66	1.30	2.32	2.20	2.93	2.44
2.15	3.16	2.66	2.10	2.87	2.88	1.72	2.67	3.07			2.10	1.84	2.34
3.26	3.86	1.98	2.84	2.82	2.44			1.38			2.70	3.21	2.64
2.71	2.73	1.73	2.30	2.56	1.82						1.98		2.56
2.38	1.88			2.98	2.60						2.43		2.85
2.71	1.93			2.80	2.48						1.93		2.27
2.58	2.86			2.70	2.90						2.80		2.11
	2.36				2.44						1.90		2.40
	3.06				2.51						2.44		2.26
	2.84				2.83						2.06		2.02
	3.77				2.50						2.31		2.06
	2.78				1.80						2.15		2.20
	2.54				2.54						2.12		1.93
	2.77				2.30						2.38		
	2.82				2.22								
	3.21				2.53								
					3.00								
					2.37								
					2.86								
					2.41								
7	~~15~~ 16	4	4	7	20	2	2	3	1	1	14	~~4~~ 3	13
18.12	~~42.00~~	8.72	9.09	19.16	49.63	4.30	5.73	7.11	1.30	2.32	31.50	~~11.19~~	30.08
2.59	~~2.80~~	2.18	2.27	2.74	2.48	2.15	2.86	2.37	1.30	2.32	2.25	~~2.80~~	2.31
~~20.10~~	45.21											7.98	
	2.83											2.66	

Ohio Agricultural Experiment Station
WOOSTER, OHIO

Sugar Maple Controlled Pollination
Progeny Test

Plantation AC-4

Crosses: April, 1955 by PH, HK
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N

		733	
			769
	925		921
4		925	921
	733	921	921
	738	929	739
	769		927
8	733	921	925
	925	921	
	736	927	738
	733	921	769
12	925	737	921
	733	733	921
	736	930	921
	927	927	926
16		927	922
	921	927	925
	927	921	927
	738	927	733
20	925	922	927
	921		923
	921	925	739
	737	738	737
24	921	733	733
	738		737
	929	921	921
	769	733	924
28		925	927
		930	923
	733	733	770
		737	921
32	733	925	927
	925	769	738
	927		927
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739	358	x	unpollinated
769	359	x	356
770	359	x	362
921	359	x	open
922	360	x	unpollinated
923	360	x	356
924	360	x	open
925	362	x	open
926	362	x	unpollinated
927	368	x	open
929	368	x	356
930	360	x	360

HBK & CRB
4-5-65

Ohio Agricultural Experiment Station

WOOSTER, OHIO

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923	360	x	356
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HBK & CRB
4-5-65

OHIO AGRICULTURAL EXPERIMENT STATION

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923	360	x	356
924	360	x	open
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926	362	x	unpollinated
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HBK & CRB
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Fifth **WORLD FORESTRY CONGRESS**

Seattle, Washington • August 29-September 10, 1960

SP/57/II - U.S.A.

Selection and Testing for Sugar Yield in Acer saccharum L.

by

H. B. Kriebel

For the production of maple syrup, sap of the sugar maple (Acer saccharum L.) is concentrated by boiling to bring it to a standard weight of 11 pounds per gallon, or 1.32 kilograms per liter. The amount of sap required to produce a given volume of syrup depends on the initial sugar content of the sap as it comes from the trees. Figure 1 shows how many gallons of sap of various concentrations are required to produce one gallon of finished syrup. The pronounced effect on this ratio of an increase in sugar content can be readily noted. Only half as much sap of 5 per cent sugar content is required to produce a gallon of syrup as is required if the sap has a 2.5 per cent sugar content, for example. Because of the considerable labor charge involved in sap collection and boiling, a significant cost reduction is obtained by producing syrup from sap of high sugar content.

Extensive studies have been made of factors affecting the sugar content of maple sap. It is now known that the tree with the highest sugar content has a very full crown, characteristic of open-grown trees. Trees of this type frequently average over 3.5 per cent sugar content. In contrast, forest-grown trees usually average 2 to 2.5 per cent sugar content (4, 5, 6). Environment therefore has an important influence on sugar content. For reasons still unknown, sugar content of an individual tree fluctuates by as much as 1.0 per cent from day to day and even from hour to hour.

In spite of this fluctuation, an individual tree which is high in sugar content in relation to its neighbors maintains this relative position from one year to the next, and a tree low in sugar content tends to remain low in relation to its neighbors (7). This is true both in forest stands and in the open, and has every indication of being an inherent characteristic, because of the consistent variation among morphologically-similar individuals, either within a forest stand or within a group of roadside trees.

Tests of several hundred mature trees have been made repeatedly over a period of years in Vermont, New Hampshire, Massachusetts, New York, Pennsylvania, Ohio, and Michigan. These records provide an excellent basis for a program of genetic selection and testing by both sexual and vegetative propagation. Such programs are currently under way in New Hampshire, Vermont, Massachusetts, and Ohio. Ease of measurement makes sugar content a very suitable characteristic for selection and progeny testing. Measurements are made either with a sap hydrometer or with a hand refractometer having a scale which reads directly in per cent solids. In maple sap these solids are 96 per cent sugars (8), meaning that the reading can be considered a direct reading of sugar per cent for all practical purposes. Only one drop of sap is required for a reading. This must be taken during a period of sap flow, which occurs when the air temperature rises to about 5 degrees Centigrade following a period of below-freezing weather. Sap is best taken when flowing directly from the tree, either from a tap-hole or from a small hole made with a pocket knife or other sharp instrument.

Tests can be made on small saplings, as well as large trees. However, sap flow is difficult to obtain from trees less than 3 centimeters in diameter just above ground level. Occasional readings can be obtained from trees 1 to 2 centimeters in diameter at an age of 3 or 4 years. Trees grown from seed often attain testing size at an age of about 7 years, and by the time trees are 10 years old nearly all can be tested. The relation between sugar content of young trees and that of old trees is not yet firmly established, although the progeny tests which we are now making in Ohio indicate that there is no relationship between age and sugar content. Sugar content of small saplings appears to be just as high as that of old trees, provided that the young trees are grown in the open where there is freedom for crown development. We have obtained numerous readings of 2 to 4 per cent in 10-year old trees, and one reading of 6.6 per cent on such a tree, the highest on record for the state of Ohio.

Clonal testing.

Close cooperation between research centers in the northeastern part of the United States has resulted in the exchange of branch cuttings and open-pollinated seed, collected from about 30 of the best trees for which long-term records are available. One obstacle to clonal testing has been the extreme difficulty of rooting cuttings taken from the selected mature trees. Considerable research at the University of New Hampshire and more recently in Vermont has produced satisfactory techniques for obtaining initial rooting, but the problem of extremely high overwintering losses of rooted cuttings has not yet been solved (1, 2). Air layering is also being tried in Massachusetts.

Because of this problem of obtaining rooted cuttings, a program of clonal testing based on grafting was started in 1955 at the Ohio Agricultural Experiment Station. The influence of rootstock sugar content on that of the scion was not known *a priori*. Any such influence, if it existed, would not affect the suitability of such clonal stock for a seed orchard, providing the characteristic were actually inherited, although it would influence sugar yield of the grafted trees themselves. However, it was considered quite possible that there would not be such an effect. If enough ramets are tested of each clone on a reasonably homogeneous group of rootstocks, statistical principles of randomization and replication can be used as they are in testing height and other environment-sensitive variables. Unless scion influence is completely overshadowed by the influence of the stock, the mean sugar percentage and the distribution of measurements around the mean will be higher for a genetically "sweet" tree than for a tree of low sugar content. Many of the grafts were made high enough on the stock to permit testing sap of both rootstock and established scion. As a further test, a series of double grafts were made, by grafting scions from a high- and low test tree on the same rootstock. Tests at three points will be possible on these trees.

The grafting program was conducted both in the greenhouse on potted rootstocks and in the nursery on lined-out stock. The program included intensive investigations of technique and factors affecting survival and growth of grafted and budded trees; as a result the percentage of success was greatly increased. Vigor of the scion was found to be the most critical factor in survival.

In 1958, a seed orchard was initially laid out, using 20 of the best clones. Table 1 lists the ortets, with pertinent data concerning origin and sugar records, also female and male parents used in progeny tests. In comparing yields of these individual trees, it is important to keep in mind the lower sugar yield of forest-grown trees than open-grown trees. Thus, a tree in a dense stand averaging 2.5 per cent sugar (e.g. tree number 272 in Table 1) may be genetically superior to a roadside tree averaging 4.0 per cent sugar (e.g. tree number 576).

The seed orchard was planted on a 30' x 30' triangular spacing, using Langner's design (3) with some modifications necessitated by irregular plot shape. First-year mortality was quite high, especially of trees budded the previous summer. Replacements have been made whenever possible by grafting in the orchard on established stocks, or by using well-established grafted trees. Because of intensive management, initiation of sap testing in the orchard will be possible in about two years.

Table 1. Records of sugar maple trees under clonal or progeny tests at the Ohio Agricultural Experiment Station.

	Tree No.	Source	Type of Tree[1]	Mean Sugar %	Range of Tests %	No. Years of Tests	No. of Tests
	272	Ohio	F	2.5	4.1 - 1.5	4	19
	273	Ohio	F	2.2	2.8 - 1.7	4	19
	354	Ohio	R	3.1	4.1 - 2.2	4	18
2	356	Ohio	+16% R	3.32 3.3	4.9 - 2.5	4	20
1	358	Ohio	+34% R	3.86 3.9	6.1 - 2.9	4	19
3	359	Ohio	R	3.0	4.3 - 2.1	4	19
	360	Ohio	R	2.7	4.0 - 2.0	4	20
	361	Ohio	R	1.7 2.8	2.5 - 1.0	3	15
	362	Ohio	R	2.6	3.8 - 2.0	4	20
	366	Ohio	R	2.7	4.3 - 2.1	4	20
4	368	Ohio	R	2.8	3.9 - 2.1	4	18
343	390	Vt.	F	2.0	3.0 - 1.4	10	128
344	397	Vt.	F	2.5	3.6 - 1.6	10	138
347	489	Vt.	F	3.9	5.8 - 2.3	10	137
351	003	N.H.[2]	R	6.0			
352	005	N.H.[2]	R	8.0			
(323) 338	545	Mass.	~6% R	4.68 4.7	6.0 - 3.6	7	20
324	572	Mass.	R	5.31 5.3	11.4 - 3.4	6	19
325	573	Mass.	R	4.66 4.7	6.2 - 3.6	6	19
(327) 339	575	Mass.	11% R	3.93 3.9	5.6 - 2.8	7	18
(328) 340	576	Mass.	10% R	3.97 4.0	6.0 - 2.6	7	18
330	583	Mass.	R	4.9	7.0 - 3.4	6	17
331	585	Mass.	R	4.0	5.6 - 3.0	6	17
332	619	Mass.	R	4.9	6.2 - 3.6	6	16
333	624	Mass.	R	4.6 = 4.43	6.0 - 3.6	5	16
334	632	Mass.	R	4.1	6.0 - 2.8	7	20
335	640	Mass.	R	3.8	5.2 - 2.8	7	20
341	662	Mass.	1% R	4.40 4.4	6.2 - 3.0	8	20
337	664	Mass.	R	4.4	6.0 - 2.8	6	18
342	669	Mass.	-4% R	4.25 4.3	5.2 - 2.0	7	15
	385	N.Y.[2]	R	4.0		7	
	386	N.Y.[2]	R	4.8		4	

[1] R = roadside; F = forest.

[2] Reported approximate averages over several years; detailed records not obtained.

Progeny testing

A second phase of the selection program is actual progeny testing. Open-pollinated seed collected from as many selected phenotypes as possible was used for the establishment of test plantations in Ohio. This type of testing is also being conducted in Vermont. Sap testing will begin on a significant scale in about three years in Ohio on progenies of about 20 Ohio and Massachusetts mother trees for which detailed performance records are on hand.

In 1955, we made controlled pollinations on six roadside trees at Wooster, Ohio, using 21 different cross combinations including selfing, open pollination and no pollination. The crossing included trees of high, intermediate, and low sugar content. Seed yields were good, and in 1959 a progeny test was established which will begin to yield information in 1961. Some of the parents are also included in both the open-pollinated progeny tests and the clonal tests, so that some information on heritability and combining ability should be forthcoming. Figure 2 shows bagging operations on these trees.

In addition to the individual tree selection, variability in sugar content is being studied in replicated provenance tests of Acer saccharum. The first of these tests was established in 1954 and now has many trees five meters or more in height. Most of the trees in this plantation have already been tested several times during the past three years, although sap flow is still rather irregular and not as extensive as it is in mature trees. These trees have been permitted full crown development to date, and tests indicate that sugar content is just as high as it is in mature trees. Data are not yet sufficient to define any regional pattern, if such pattern exists. Larger provenance tests, including more seed origins, were established three years later. These plots will provide a more sensitive test of geographic variation, from which it can be determined whether any correlation exists between winter hardiness and sugar content of the sap. Such a relationship is suggested by the lower average sugar percentages and syrup yields obtained in Ohio than in northern New England and New York.

Conclusions

In conclusion, several considerations make sugar content of Acer saccharum an excellent character for genetic selection and testing. First, the intensive studies of tree variability in sugar content during the past decade or so throughout the commercial maple sugar producing region have provided the basic information for selection and testing. Second, sugar content of young trees in experimental plots appears to be comparable to that of mature trees, thus making early parent-progeny correlations feasible. Third, the simplicity of measurement and the likelihood of obtaining sufficient sap tests for an accurate assessment of filial performance by the tenth or twelfth year are favorable to heritability estimation. Simultaneous clonal propagation and seed orchard establishment partly overcome the obstacle of a long reproductive cycle. Further study will be needed to develop economical methods of vegetative propagation for rapid commercial utilization of élite trees.

Totalization and Averaging of Tree Means 3/17/65

360 OPEN	362 x OPEN	358 x OPEN	358 x 356	358 x SELF (UN)	358 x 362	359 x 356	359 x OPEN	360 x SELF (UN)	360 x 356	368 x OPEN	362 x SELF (UN)	368 x 356	359 x 362
2.95	2.60	3.30	2.83		1.80	2.87	1.92	3.40	1.53	1.92	3.07	2.72	3.10
3.60	1.93	3.00	3.50	2.05	2.83	3.32	2.52	3.26		1.95		2.33	2.10
	1.85	3.46	4.95	2.60	3.75	2.00	1.90	2.10		2.90		4.22	
	2.00	2.40	2.68	2.37	2.30	2.67	1.00			2.43			
	2.30	2.13	2.20	2.30		2.12	2.30			2.33			
	1.65	2.75	2.20	1.90		4.10	1.55			1.50			
	2.10	3.24	2.52			3.93	2.30			3.20			
	2.80		2.50				2.87			2.30			
	1.65		4.02				2.28			1.90			
	2.17		3.00				2.95			1.00			
	1.97		4.63				2.53			2.10			
	1.88		3.20				2.55			3.75			
	2.00		3.07				2.85			1.70			
	1.90		2.63				2.70			2.68			
	1.85		2.18				2.16			2.53			
			2.28				2.60			2.00			
							3.48						
							4.83						
							2.33						
							2.54						
							2.44						
2	15	7	16	5	4	7	21	3	1	16	1	3	2
6.55	30.65	20.28	48.39	11.22	10.68	21.01	52.60	8.76	1.53	36.19	3.07	9.27	5.20
3.28	2.04	2.90	3.02	2.24	2.67	3.00	2.50	2.92	1.53	2.26	3.07	3.09	2.60
1	13	7	4	12	8	5	10	6	14	11	3	2	9

	356	362	OPEN	Self	Unp.
356			4.4		
358	(2) 4.0	(4) 3.8	(1) 4.4	3.4	2.9
359	(3) 3.9	3.9 2.9 3.4	(5) 3.5		
360	1.8		4.4	4.6 1.6 3.1	4.0
362			2.8		3.0
368	3.4		2.6		

3/17/65

Means of Tree Means

	356	358	359	360	362	OPEN
358	3.02	2.24			2.67	2.90
359	3.00				2.60	2.50
360	1.53			2.92		3.28
362					3.07	2.04
368	3.09					2.26

Thru 1965

Means of Tree Means

Ortet or Parent	AC-1			AC-4			AC-5			
343?	358 x 356	4.23	5.4 1 ✓	360 x OPEN	3.28	L x ?	323	(4.7)	2.37	2.16
4.7	323 ?	3.92	5.1 3 ✓	368 x 356	3.09	3.37 I x H	332	(4.9)	2.35	2.03
3.9 ✓	347	3.90	5.0 6 ✓	362 x SELF	3.07	L x L	337	(4.4)	2.25	2.11
3.3	356	3.67	4.4 2	358 x 356	3.02	4.05 H x H ✓	328	(4.0)	2.18	2.15
	273	3.17	4.0 4	359 x 356	3.00	3.87 I x H	325	(4.7)	2.18	2.15
6.0	351	3.10	3.9 5 ✓	360 x SELF	2.92	L x L	333	(4.6)	1.98	1.81
4.8	386	3.10	3.9 9	358 x OPEN	2.90	4.38 H x ?	334	(4.1)	1.95	1.84
3.1 ✓	354	2.87	3.8	358 x 362	2.67	3.82 H x L	331	(4.0)	1.93	1.91
	358	2.71	3.3 ✓	359 x 362	2.60	I x H	335	(3.8)	1.92	1.55
	Rootstocks	2.59	3.7	359 x OPEN	2.50	I x ?	324	—	1.89	1.93
	272	2.55	3.0	368 x OPEN	2.26	3.35 I x ? ✓	327	(3.9)	1.89	1.87
3.9	327	2.50	3.0 8	358 x SELF	2.24	H x H ✓	330	(4.9)	1.73	1.66
	341	2.50	3.4	362 x OPEN	2.04	2.79 L x ?				
	328	2.45	3.7 10 ✓	360 x 356	1.53	L x H				
	342	2.42	3.2							
✓	385	2.35	3.3							

AC-4

Totalization and Averaging of Tree Means 5/6/65

360 x OPEN	362 x OPEN	358 x OPEN	358 x 356	358 x SELF(UN)	358 x 362	359 x 356	359 x OPEN	360 x SELF(UN)	360 x 356	368 x OPEN	362 x SELF(UN)	368 x 356	359 x 362
2.90	2.20	2.02	2.42	2.27	1.88	2.50	2.10	2.65	1.30	2.65	2.08	2.35	2.45
2.87	1.67	2.10	3.20	2.55	2.22	2.42	2.72	2.68		2.05		1.85	1.80
	2.40	3.55	3.78	1.90	1.75	2.77	1.80	1.28		2.15		3.30	
	1.85	2.42	2.35	1.70	2.75	2.38	1.37			2.15			
	2.40	2.00	1.57		2.35	2.75	2.42			2.50			
	1.53	2.38	1.75			2.50	1.97			1.57			
	2.48	2.58	2.88			2.65	2.48			1.88			
	1.90		2.75				2.42			1.95			
	2.45		2.55				2.45			2.38			
	1.70		3.55				2.75			1.85			
	2.28		3.20				2.32			2.00			
	1.85		2.90				1.50			1.85			
	2.18		2.08				2.43			1.72			
	2.12		2.50				2.07						
			3.12				2.10						
							2.38						
							3.32						
							2.40						
							2.42						
							2.02						
2	14	7	15	4	5	7	20	3	1	13	1	3	2
5.77	29.01	17.05	40.60	8.42	10.95	17.97	45.44	6.61	1.30	26.70	2.08	7.50	4.25
2.88	2.07	2.44	2.71	2.10	2.19	2.57	2.27	2.20	1.30	2.05	2.08	2.50	2.12
1	13	5	2	11	9	3	7	8	6	14	12	4	10
1	13	5	2	11	9	3	7	8	6	14	12	4	10
2.90	2.48	3.55	3.78	2.55	2.75	2.75	3.32	2.68	1.30	2.65	2.08	2.35	2.45
4	9	2	1	8	5	5	3	6	13	7	12	11	10

5/6/65

Means of Tree Means

	356	358	359	360	362	OPEN
358	2.71	2.10			2.19	2.44
359	2.57				2.12	2.27
360	1.30			2.20		2.88
362					2.08	2.07
368	2.50					2.05

AC. 4 (% Sugar) Test of 3/20/62 to 3/28/62

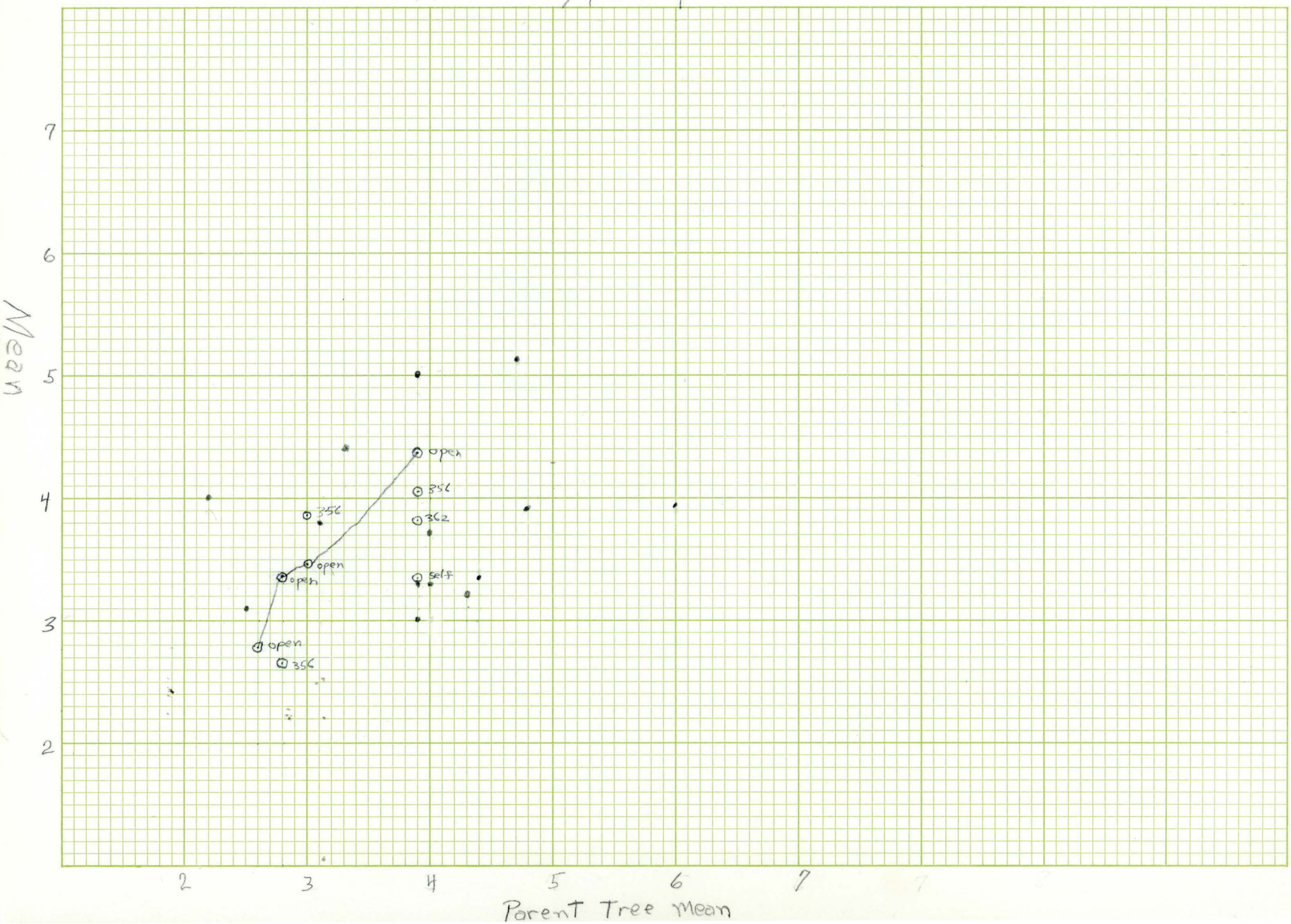
♂ / ♀	356	362	OPEN	Self	unp.			356	362	OPEN	Self	Unp.
356			1.6									
358	2.0	1.4	2.2	1.8	2.4							
359	2.0	2.4	2.0									
360	1.6		2.8	3.6	2.4							
362			1.5									
368	2.6		1.8									
~~369~~			~~2.5~~									

	356	362	OPEN	SELF	UNP
356					
358					
359					
360					
362					
368					

AC-4 (Sugar tests of 3/20/62 to 3/28/62)

Source	Σ	No. of measurements	% Sugar $\bar{x}$	Rank
356 X OPEN	3.1	2	1.6	9
358 X OPEN	10.8	5	2.2	6
359 X OPEN	60.9	31	2.0	7
360 X OPEN	11.1	4	2.8	2
362 X OPEN	34.7	23	1.5	10
368 X OPEN	42.7	23	1.8	8
369 X OPEN	2.5	1	2.5	4
358 X 356	33.3	17	2.0	7
358 X 362	2.8	2	1.4	11
358 X self	7.0	4	1.8	8
358 unp	7.1	3	2.4	5
359 X 356	22.3	11	2.0	7
359 X 362	14.2	6	2.4	5
360 X 356	1.6	1	1.6	9
360 X Self	3.6	1	3.6	1
360 unp	4.9	2	2.4	5
368 X 356	10.5	4	2.6	3

AC1 & AC-4


Mean
7
6
5
4
3
2
open
356
362
self
356
open
open
open
356
2
3
4
5
6
7
Parent Tree Mean

3/13/64

AC-1 Sap Test

Origin	Acess. No.	Mean % Sugar	Mother Tree Max (woods)	Mother Tree Max (open)	
Ohio	358 x 356	5.41			
Mass.	338	5.12		6.0	
Vermont	347	4.97	5.8		
Ohio	356	4.41	4.9	4.9	I
Ohio	273	4.03	2.8		
N.H.	351	3.94	6.0	6.0	
N.Y.	386	3.93	4	4.8	
Ohio	354	3.80	4.1	4.1	L
Mass.	340	3.72	6.0	6.0	
Mass	341	3.35		6.2	
Ohio	358	3.30	3.9	6.1	H
N.Y.	385	3.30		4.0	
Mass	342	3.24		5.2	
Ohio	272	3.12	4.1		
Mass	339	3.04		5.6	

AC-4 3/16/64

Cross	Mean % Surgar		
358 x OPEN	4.38	1	H x ?
358 x 356	4.05	2	H x H
358 x Self	3.35	7	H x Self
358 x 362	3.82	4	H x L
359 x 356	3.87	3	I x H
359 x OPEN	3.47	5	I x ?
362 x OPEN	2.79	8	L x ?
368 x OPEN	2.65	9	I x ?
368 x 356	3.37	6	I x H

Apple Creek Maples - Controlled Pollination

Planted November, 1959

~~East~~ South West Reversed

Row I

359? 369 x 362 359
368 Open
359 Open
358 x 356
362 Open
358 x 356
359 Open
358? 359 x 358
? 359 Open
? 358 Open ~~368 Open~~ 358 x 356
2 trees not listed ? 358 Open
? 368 Open
359 Open
359 x 362
360 x 356
368 Open
360
359 Open
358 x 362
358 x 356
358 x 362
South ? 358 Open
360 x 356
368 Open
358 x 356
368 Open
362 Open
360 UNP
362 UNP
359 Open
? 358 Open 359 Open
359 x 356

362 Open
368 Open
358 UNP
358 Open
359 Open
359? 369 Open
359 x 356

368 x 356

Row II

362 Open
? 368 x 356
358 x 356
360 Open
359 x 356
362 Open
358 x 356
359 Open
359 Open
360 Self
359 Open
368 x 366 356?
359 x 356
362 Open
358 x 362
358 x 356
360 Self
362 Open
358 x 356
359 Open
359 Open
?

358 Open
? 362 Open
? 358 Open
360 UNP
368 Open
359 Open

? 360 Open

360 Open
358 x 356
358 x 362
359 Open
?

359 Open
?
?

368 x 356
359 Open
362 Open

358 x 362

358 x 356

Row III

359 x 356
362 Open
358 x 356
362 Open
359 Open

358 x 356

368 Open
368 Open
358 x 356
368 Open
362 Open
358 x 356
362 Open

359 x 356
358 x 356
359 x 356
368 x 356
358 Open
359 Open
358 x 362
359 Open
359 Open

358 Self

359 Open
359 Open

358 Self
358 x 356
362 Open
368 x 356
358 Self
362 Open
358 x 356
359 x 356
358 Open
358 x 356
360
362 Open

North

North

Height of Progenies (cm) 10-23-59

Families

	733(358x356)	" "	736(358x358)	737(358x362)	738(358xopen)	739(358xunp.)	769(359x356)	770(359x362)	921(359xopen)	922(360xunp.)	923(360x356)	924(360xopen)	925(362xopen)	926(362xunp.)	927(368xopen)	929(368x356)	930(360x360)	(362x362)	(368x366)	~~(358x356)~~
	13	83	71	28	84	48	33	169	118	188	29	193	140	100	177	178	134	14	75	
	66	97	127	18	32	48	43		57	119	33	10	156		56	163	52			
	35	92	70	17	54		63		80		47	15	114		105	50	41			
	35	60		28	102		26		76			84	193		148	103				
	22	70		18	45		111		46				298		187					
	15	61		85	61		107		47				16		15					
	16	84		67	68		96		76				65		77					
	30	67		68			133		11				135		91					
	16	81					118		20				52		34					
	30						130		28				88		47					
	36						101		80				133		123					
	45						15		112				108		63					
	45								181				61		74					
	32								169				50		89					
	20								112				88		39					
	62								138				56		49					
	79								172				85		95					
	140								87						226					
	60								30											
	109								17											
	149								82											
	129								156											
	89								122											
	138								159											
	83								137											
	167																			
	145																			
	48																			
	82																			
	22																			
Sum		39	3	8	7	2	12	1	25	2	3	4	17	1	18	4	3	1	(1)	
9/26/56 →		(68)	(2)	(12)	(27)	(6)	(12)	(2)	(38)	(4)	(3)	(7)	(27)	(6)	(21)	(10)	(8)	(2)	(1)	
Mean			✓			✓				✓				✓			✓	✓		

	selfs	(Percent)	crosses	Percent
1959:	12	0.43	139	0.6
1956:	(28)		228	

1955 CP Seedlings - Sugar Maple

Height of Progenies - 7-16-57
(CM)

Families

733 (358 x 356)		736 (358 x 358)	737 (358 x 362)	738 (358 x open)	739 (358 x unp.)	769 (359 x 356)	770 (359 x 362)	921 (359 x open)	922 (360 x unp.)	923 (360 x 356)	924 (360 x open)	925 (362 x open)	926 (362 x unp.)	927 (368 x open)	929 (368 x 356)	930 (360 x 360)	(362 x 362)	362-5-609
50	7	45	13	12	11	40	50	37	14	8	30	16	34	1	11	18	3	8
28	27		14	22	24	15	39	40	6	19	66	7	9	9	22	4		
4	7		16	16		33		27	57		5	42		6	25	3		
12	34		4	31		55		32	44		15*	10		49	66	29		
46	45		5	38		26		19			6	7		10	41			
20	4		5	16		4		39				4		53	56			
4	3		50	29		48		25				45		17				
6	21		14	8				17				9		17				
4	68		13	5				12				6		29				
29	25			13				6				23		18				
7	22			9				16				8		14				
19	___	Sum		46				8				46		4				
36	___	Mean						40				25		18				
62								37				9		21				
66								27				9		17				
29								39				33		15				
9								26				9		33				
56								50				14		34				
44								10						27				
42								29						20				
8								33										
23								38										
18								14										
43								49										
11								76										
14								11										
2*								15										
4								48										
32								49										
26		Sum																
49																		
35		Mean																
25																		
8																		

* broken or cut off

1955 CP Seedlings - Sugar Maples

Height of Progenies (cm) 9-26-56.

733 (358x356)	"		736 (358x358)	737 (358x362)	738 (358x open)	739 (358 x unp.)	769 (359x356)	921 (359 x open)	"	922 (360 x unp.)	923 (360x356)	924 (360 x open)	925 (362 x open)	926 (362 x unp.)	927 (368 x open)	929 (368x356)	930 (360x360)	(362x362)	(362x Sbew)
5.0	13.0		14.6	7.5	10.0	4.0	8.5	5.8	5.2	38.0	10.0	4.0	19.0	6.5	9.0	5.0	9.0	7.5	4.0
2.5	11.4		9.0	5.0	6.0	3.0	5.2	13.0	11.3	29.0	4.0	16.2	30.0	1.0	4.0	11.0	4.0	3.0	
19.5	6.0			4.5	5.8	3.0	5.0	5.2	15.0	26.0	9.0	12.0	6.0	3.5	4.0	6.0	3.0		
5.4	17.6			8.8	5.0	6.5	4.7	1.8	5.0	4.0		5.0	11.0	3.5	12.0	6.0	6.0		
8.0	3.5			6.0	6.0	10.0	5.6	7.0				9.5	10.0	4.0	8.0	8.5	1.0		
10.2	24.5			2.0	7.0	1.5	12.0	4.5				9.5	5.0	3.0	13.5	14.0	6.0		
4.5	5.2			3.5	10.5		5.0	12.0				4.0	2.0		5.5	6.0	6.5		
5.5	4.5			4.8	8.6		26.1	2.0					3.0		3.0	13.0	5.0		
5.9	3.5			10.0	7.0		11.0	17.4					15.0		6.0	7.0			
18.3	4.2			4.0	6.0		3.4	7.5					6.0		6.2	7.2			
14.0	4.7			4.0	6.0		4.7	10.0					5.0		4.5				
35.9	6.2			3.5	3.0		10.5	2.5					3.5		7.0				
3.5	6.0				5.0			10.3					5.0		4.5				
3.5	6.5				4.8			8.9					14.0		7.0				
18.0	12.0				12.0			3.0					6.5		7.0				
3.8	5.0				17.9			8.0					3.0		5.0				
17.0	15.0				6.0			5.0					5.0		5.0				
7.2	7.0				7.7			8.0					3.0		8.0				
2.6	12.0				6.5			7.5					2.0		7.2				
20.5	7.8				5.0			10.8					12.0		3.5				
12.0	9.0				4.0			6.0					4.0		7.3				
9.2	8.6				6.0			9.0					4.0						
3.5	6.0				5.7			9.0					3.5						
4.2	7.0				15.1			8.9					5.5						
4.0	8.0				6.3			7.0					9.0						
5.9	4.3				7.5			14.2					8.0						
4.3	7.3				4.6			7.5					9.0						
4.5	16.5	Sum	2	12	27	6	12	9.2	4	4	3	7	27	6	21	10	8	2	1
3.0	4.8							10.5											
4.1	7.2	Mean						9.3											
10.0	3.0							7.0											
5.0	20.0							21.0											
6.5	11.0	Sum 68						6.0	Sum 38										
4.5	6.0	Mean ____						8.8	Mean ____										

1955 C P Seedlings - Sugar Maple

Height of Progenies (CM) 9-12-57

Families

733 (358 x 356)		736 (358 x 358)	737 (358 x 362)	738 (358 x open)	739 (358 x unp.)	769 (359 x 356)	770 (359 x 362)	921 (359 x open)	922 (360 x unp.)	923 (360 x 356)	924 (360 x open)	925 (362 x open)	926 (362 x unp.)	927 (368 x open)	929 (368 x 356)	930 (360 x 360)	(368 x 366)	(362 x 362)	(359 x 359)
51	51	49	13	14	25	8	41	40	14	10	7	49	6	22	44	18	58	9	
14	24		16	26	12	7	4	38	6	20	33	12		2	68	6		6	
36	37		55	17		7		40	63	21	68	11		28	25	3			
6	26		6	32		42		38	49		16	9		35	24	30			
13	16		6	40		17		39			7	5		33	14				
48	9		5	18		33		14				63		24					
23	27		16	31		6		30				14		20					
5	14		16	18		58		33				7		10					
45	35		3	22		26		40				36		56					
10	46		14	52		7		17				10		15					
7	6					50		7				9		74					
5	4							50				54		19					
30	62							90				27		19					
9	39							11				26		35					
25	23							17				10		9					
37	Sum							45				50		44					
62	Mean							52				10		31					
61								18				23		8					
11								38				14		22					
15								45				16		24					
12								29				22							
45								33				34							
19								5				6							
34								20				40							
11								46				76							
44								20				13							
26								12											
44								7											
56								17											
12								60											
37								7											
6	Sum																		
35																			
27	Mean																		

Initial growth measurements, 1st flats planted: 83, 78, 49, 64, 48

1956

Cross	No. seedlings	Total Height	Mean Height	Total Leaf length	Mean Length
6 x 4	55	283.2	5.1	246.6	4.5
6 x 8 6x8	5	21.9	4.4	21.2	4.2
6 x 10	14	62.7	4.5	64.1	4.6
6 - self	4	16.2	4.0	17.7	4.4
6 - open	13	69.3	5.3	64.8	5.0
6 - un	10	44.2	4.4	41.9	4.2
7 x 4	9	60.7	6.7	45.8	5.1
7 x 10	4	28.3	7.1	25.5	6.4
7 - open	22	117.1	5.3	116.6	5.3
8 x 4	2	7.1	3.6	7.4	3.7
8 - open	2	5.5	2.8	5.5	2.8
10--self	5	28.6	5.7	21.7	4.3
10- open	42	213.6	5.1	196.0	4.7
10 - un	20	84.0	4.2	77.8	3.9
	4	15.8	4.0	17.1	4.3
10- s bag					
16 x 4	5	27.7	5.5	23.4	4.7
16 x 8	2	9.1	4.6	8.3	4.2
16 x 14	6	37.5	6.2	31.3	5.2
16 - open 16	9	56.6	6.3	55.3	5.1
Total	154	693.1	3.8	448.3	2.9
	233	1189.1	5.1	1088.0	2.7
Cross	102	538.2	5.3	473.6	4.6
Open	88	462.1	5.2	438.2	5.0
Self	9	44.8	5.0	39.4	4.4
Un	30	128.2	4.3	119.7	4.0
Misc.	4	15.8	4.0	17.1	4.3

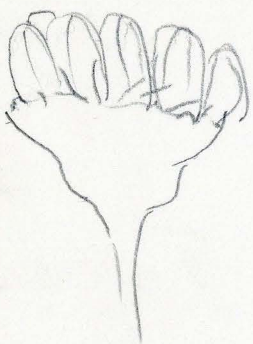
Form 5919

Initial growth measurements, 1956; last six flats planted: 97, __, 85, 60, 92, 81.

Cross	No. seedlings	Total Height	Mean Height	Total Leaf length	Mean length
6 x 4	62	254.9	4.1	204.5	3.3
6 x10	4	10.2	2.6	10.0	2.5
6 - self	3	14.1	4.7	11.7	3.9
6 - open	15	53.1	3.5	38.1	2.6
6 - un	8	29.6	3.7	19.4	2.4
7 x 4	4	15.5	3.9	11.9	3.0
7 x 10	1	2.8	2.8	1.3	1.3
7 - self	2	4.6	2.3	2.2	1.1
7 - open	13	48.1	3.8	30.8	2.4
8 x 4	3	7.5	2.5	5.2	1.7
8 - self	3	6.4	2.1	5.6	1.9
8 - open	1	3.9	3.9	3.0	3.0
8 - un	2	4.7	2.4	2.5	1.2
Tree 8	1	2.4	2.4	1.1	1.1
10 - self	1	2.9	2.9	1.7	1.7
10 - open	4	14.7	3.7	10.1	2.5
10 - un	4	19.0	4.8	9.5	2.4
16 x 4	2	10.0	5.0	9.4	4.7
76 open	21.	87.7	4.2	65.3	3.1
Total	154	593.1	3.8	444.3	2.9
Cross	76	200.9	4.0	242.3	3.2
Open	54	208.5	3.9	148.3	2.7
~~Self~~	~~8~~	~~28.0~~	~~3.5~~	~~21.2~~	~~2.6~~
Un	14	53.3	3.8	31.4	2.2
Misc.	1	2.4	2.4	1.1	1.1

Form 5919

♂



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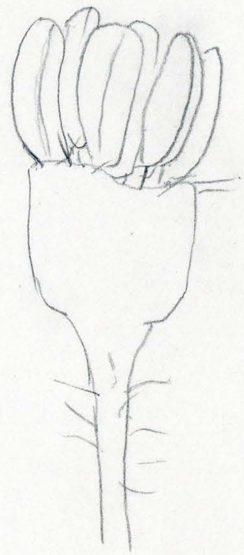
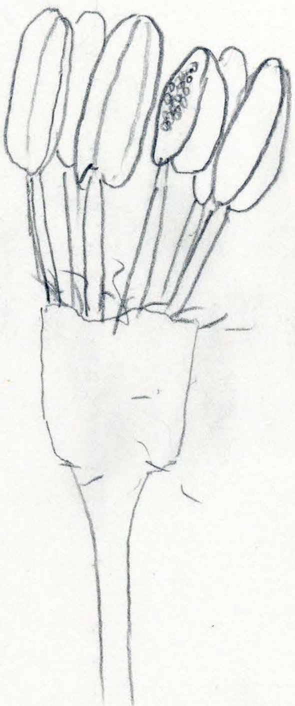


II



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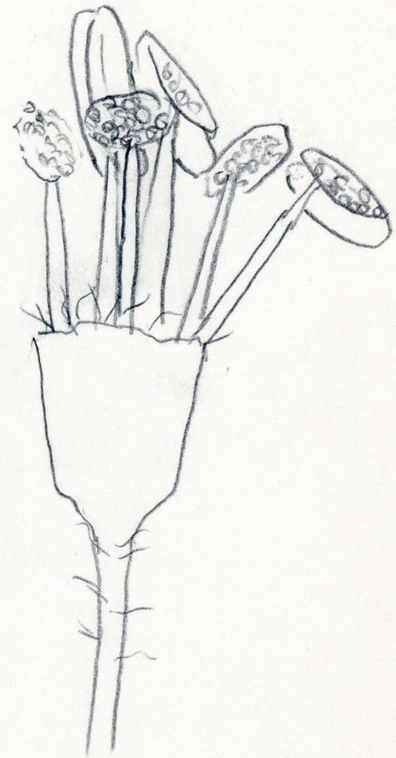
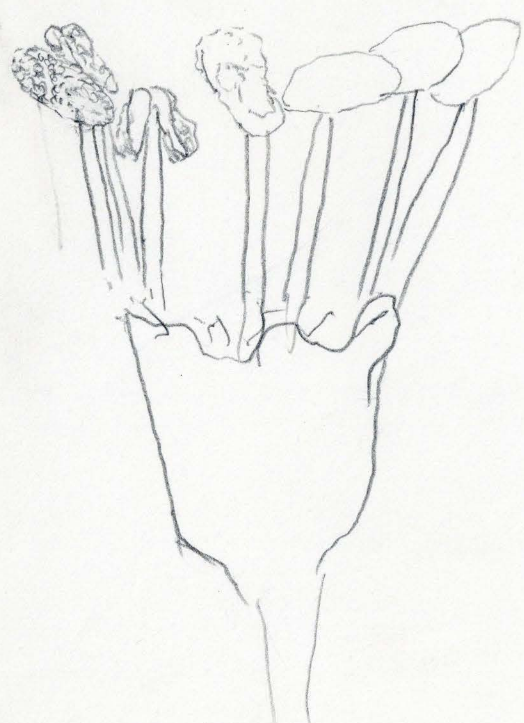


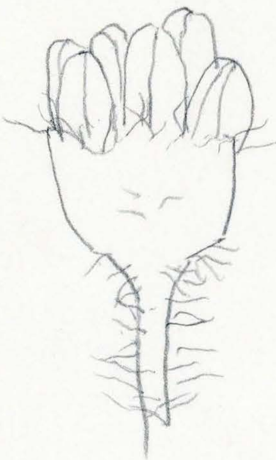
IV

♀



V

♀



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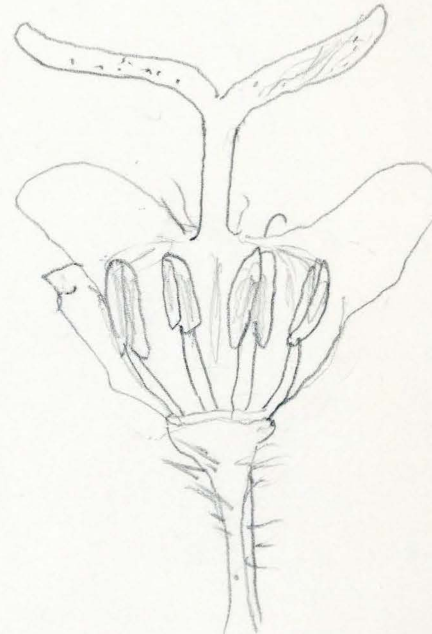
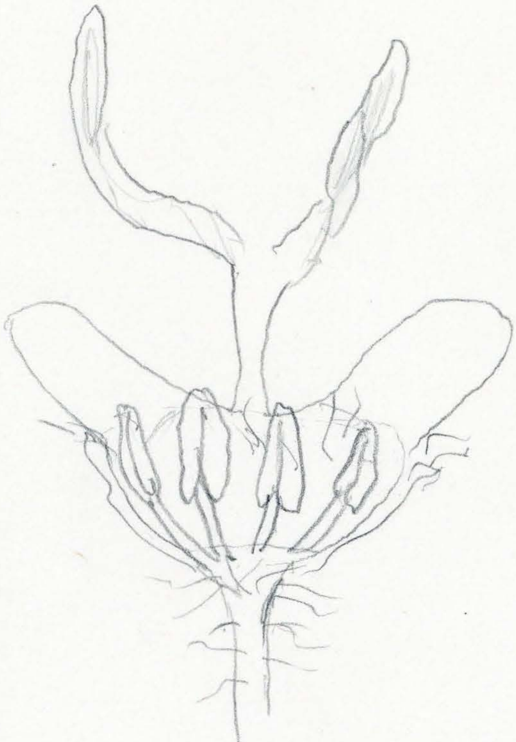
II



III



IV

No. of seeds by bag type

C	P	S
2	1	6
4	1	1
1	1	4
2	1	10
1	2	7
1	2	1
16	1	4
5	5	1
1	1	2
1	2	36
1	1	
3	1	
2	5	
1	24	
3		
44		

By Parent

#6 = 77 seeds germ

7 = 9 " "

8 = 17 " "

10 = 49 " "

16 = 5 " "

No of seeds

4 ?

Open		Self	Cross			Un	
2	15	1	2	1	1	2	1
2	2	1	1	2	2	1	5
6	2	6	1	4	2	1	8
1	1		1	16	1	1	
2	1		1	5	3	1	
3	21		2	4	2	1	
7			4	5	1	4	
3				1	1	1	
26		8	16	38	13	12	13

= 47

= 67

25

Tue #6 (Cont)

1	10 x 6 - (?)	4/14	9/12
2	6 x 4 - P	4/14	9/12
2	Open Poll	5/3	9/12
2	6 - Un - P ♀♂	4/12	9/12
1	Un - P	4/12	9/12
4	6 x 4 - S	4/10	9/9
1	6 x 6 - Self poll	4/14	9/12
1	Un - S ♀♀	4/12	9/12
1	6 - Un - C	4/12	9/12
1	6 - Un - C ♀♀	4/19	9/12
16	6 x 4 - C	4/12	9/12
5	6 x 4 - P	4/12	9/12
4	6 x 4 - ?	4/12	9/9
5	6 x 4 - C	4/12	9/12
4	Open Poll	5/3	9/12
1	6 x 10 - C	4/12	9/9
1	6 x 4 - P	4/12	9/12
2	6 x 10 - S	4/9	9/9
2	6 x 10 - P (?)	4/12	9/13
1	6 - Un - C ♀♀	4/12	9/12
1	6 x 4 - C	4/10	9/9
3	6 x 4 - C	4/12	9/12
6	open poll	5/3	9/9
1	" "	5/3	9/12
2	6 x 4 - C	4/12	9/12
2	6 x 10 - P	4/12	9/9

69 (+9) = 78

Tue #8

1	8 x 4 C	4/19	9/9
1	8 x 8 - P	4/12	9/9

2 +

Tree #16

		Poll.?	Collected?	
2	16 x 14 - C,	4/15	Coll. 9/8	
1	16 x 14 - P	4/15	" 9/8	?
~~2~~	~~5 x 4~~		~~9/8~~	
2	open poll	5/4	9/8	
5 -				

Tree #10

3	Open Poll.	5/14	9/9
7	" "	5/14	9/9
4	Un - 10 - C	4/12	9/9
3	10 open poll.	5/14	9/9
6	10 x 10 - S	4/12	9/9
15	Open poll	5/14	9/9
1	10 - ♀Un♀ S	4/12	9/9
1	10 - ♂Un♂ - P	4/12	9/9
4	S bg		9/9
5	10 - ♂Un - ♀S	4/12	9/9
49			

Tree # 7.

1	7 x 4 - C	4/12	9/9
1	7 x 10 - P	4/12	9/9
2	open poll	5/7 (?)	9/9
1	7 x 10 - P	4/12	9/7
2	open poll	5/7	9/9
2	7 x 4 C	4/12	9/7
9			

Tree #6

1	10 x 6 - S ⚥	4/12	9/12
7	10 x 6 - S	4/12	9/12
7 +			

Tree # 8

1	open Poll	4/12	9/8
2	—	—	9/8
1	—	—	9/8
1	open poll	4/12	9/8
5	4thw - P ♀♀	4/19	9/8
3	8X4 - C	4/19	9/8
2	—	—	9/8

15 (+2) = 17

Dec. 5, 1956

OAES—56

Proposed research on pollen and seed setting of sugar maple

~~D. Pollen collection and storage techniques~~

a. identification of dormant flower buds

b. timing, temperature, and humidity conditions for forcing cut branches to produce pollen.

c. Duration of viability of pollen under different storage conditions of temperature and humidity, (pollen germination tests.

d. Flower bud and flower morphogenesis fertilization; embryo and seed development.

e. Degree of self-incompatability under natural and controlled crossing.

f. Individual tree variation in degree of self-sterility and parthenocarpy,

g. Variation in different parts of the tree crown in seed viability.

h. Relation of timing of male and female flower development to position in tree crown and to parent tree;

Cross	NO	Seeds collected	Seeds viable	%
1) 6 x 4	26	1247	337	27.0
2) 6 x 8	8	170	34	20.0
3) 6 x 10	15	557	104	18.6
4) 7 x 4	9	176	47	26.7
5) 7 x 8	1	2	—	—
6) 7 x 10	6	65	6	9.2
7) 8 x 4	5	296	32	10.8
8) 8 x 8	5	160	14	8.7
9) 10 x 4	2	50	3	6.0
10) 10 x 10	3	59	19	32.2
11) 16 x 4	5	62	18	29.0
12) 16 x 8	2	41	5	12.2
13) 16 x 14	1	18	6	33.3
	88	2853	315	= 11.0
1) Self - 6	6	119	24	20.2
2) Self - 7	9	—	—	—
3) Self - 8	9	285	50	17.5
Total	24	404	74	= 18.3
1) Un - 6	11	312	40	12.8
2) Un - 7	1	—	—	—
3) Un - 8	3	205	25	12.2
4) Un 10	6	729	105	14.4
Total	21	1246	170	= 13.6
1. op				
				27.1
1. open poll - 6	5	236	64	27.1
2. open poll - 7	8	265	126	47.5
3. open poll - 8	5	347	128	36.9
4. open poll - 10	5	350	124	35.4
5. open poll 16	3	72	64	88.9
Total	26	1270	506	= 39.8

Bag type	No bags	No seeds at collection	Viable seed	%
P				
1 Tree #6	24	969	209 =	21.6
2 Tree #7	10	78	18 =	23.0
3 Tree 8	7	279	42 =	15.0
4 Tree #10	2	174	9 =	5.2
5 Tree #16	3	32	7 =	21.9
Totals	45	1532	285	18.6

Bag type	No bags	No seeds at collection	Viable seed	%
C				
1 Tree #6	31	1099	257	23.4
2 Tree #7	7	168	37	22.0
3 Tree #8	9	643	26	4.0
4 Tree #10	3	165	40	4.[illegible]
5 Tree #16	6	85	22	25.[illegible]
Totals	56	2160	382 =	17.7

Bag type	No bags	No seeds at collection	Viable seed	%
[illegible]				
1 Tree #6	9	282	49	17.4
2 Tree #7	1	—	—	—
3 Tree #8	6	163	3	1.8
4 Tree #10	7	350	97	27.7
5 Tree #16	2	4	—	—
Totals	25	799	149	18.6

Pollination	Type bag	No bags	No seeds at collection	No viable seed	% O
Tree 6					
1) 6x4	P	9	512	130	= 25.4
2) 6x4	C	13	630	196	= 31.1
3) 6x4	S	4	105	11	= 10.5
4) 6x10	C	6	143	10	= 7.0
5) 6x10	P	6	276	67	= 24.3
6) 6x10	S	3	138	27	= 19.6
7) 6x8	C	5	144	29	= 20.1
8) 6x8	P	3	26	5	= 19.2
9) Self	C	2	24		
10) Self	P	1	40		20.2
11) Self	?	2	55	24	
12) Un	P	4	115	7	6.0
13) Un	C	5	158	22	13.9
14) Un	S	2	39	11	28.2
15 Open Poll.		5	236	64	27.1
S bag		1		1	
Tree 6		17			
Totals		49	2641	604	= 22.9
Tree #7					
1) 7x4	C	4	158	35	22.1
2) 7x4	P	5	18	12	66.7
3) 7x8	P	1	2	0	—
4) 7x10	P	4	58	6	10.3
5) 7x10	C	2	7	2	28.9
6) 7-Un	S	1	0	—	—
7) 7-Un	C	1	0	—	—
8) open Poll	?	8	265	126	47.5
Self poll		—	9	—	?
Totals		26	517	181	= 35.0
Tree 8					
1 8x4	S	1	—		
2 8x4	C	3	262	26	9.9
3 8x4	P	1	34	6	17.6
4 8x8	C	1	93	—	—

Cross	Type bag	No. bags	No seeds	No. viable seeds	%
Tree 8 (Cont.)					
5) 8 x 8	P	3	67	14	20.9
6) selfed	?	8	285	50	17.5
7) selfed	S	1	0	—	—
8) Open Poll.	?	5	347	128	36.9
9) —	P	2	85	—	—
10) —	S	3	155	—	—
11) —	C	3	185	—	—
12) Un	S	1	9	3	33.3
13) Un	P	1	93	22	23.7
14) Un	C	1	103	—	—
15 Tree 8				33	
Totals		36	1718	282	16.4
Tree 10					
1) 10 x 4	S	1	—		
2) 10 x 4	P	1	50	3	6.0
3) 10 x 10	C	1	—		
4) 10 x 10	S	2	59	19	32.2
5) Un	P	1	124	6	4.8
6) Un	C	2	165	40	24.2
7) Un	S	3	214	59	27.6
8) open Poll	?	5	350	149	40.3
9) —	S	1	77	19	24.7
Totals		17	1039	270	= 26.0
Tree 16					
1) 16 x 4	P.	1	16	6	37.5
2) 16 x 4	C	3	42	12	28.6
3) 16 x 4	S	1	4	—	—
4) 16 x 8	P	1	16	1	6.3
5) 16 x 8	C	1	25	4	16.0
6) 16 x 14	C	1	18	6	33.3
7) open poll	?	5	72	71	99.9
8)	P	1	—		
9)	S	1	—		
10)	C	1			
Totals		16	192	93	48.4

1955 Maple Breeding Experiments

All Trees	Pollination Date 1	2	3
A. Parchment bag			
1. Self-pollinated			
a. no pollen injected	10	10	10
b. pollen injected	10	10	10
~~2. Open-pollinated~~	~~20~~	~~20~~	~~20~~
3. Controlled-pollinated	30	30	30
4. Unpollinated (emasculated)	5	5	5
B. Cloth bag			
1. Self-pollinated			
a. no pollen injected	10	10	10
b. pollen injected	10	10	10
~~2. Open-pollinated~~	~~20~~	~~20~~	~~20~~
3 Controlled-pollinated	30	30	30
4. Unpollinated (emasculated)	5	5	5
C. Sausage casing bag			
1. Self-pollinated			
a. no pollen injected			
b. pollen " "			
2. Controlled-pollinated			
3. Unpollinated			

Code for tags:

P = parchment — (1) = Selfed (a) or (b)

C = cloth — ~~(2) = Open~~

S = sausage casing — (3) = control-pollinated

(4) = unpollinated

Examples of tag labeling:

6 x 4 - P 4/10/55	Open 4/10/55
4 x 4 (a) — C 4/10/55	Unp. - P 4/10/55

Flowering Branches of Lane Trees
Microscopic Sex Determination

	(361) 9H	9N	9S	9H
Microsc.	Perfect	(Perfect)	(P)	(P)
Macro (after opening)	♀		♀	

	(356) 4	(364) 12S	12N	(365) 13S	13N
Micros.	(♂)?	(P)	(P)	(P) F	(P)?
	♂	♂ ♀	♀		♀

	(362) 10S	10N	(363) 11S	11N	C
Micro	(♂)?	(P)	(P)?	(P)?	(P)
	?♂ ♀	♂ ♀	♀		♀

	(360) 8H	8H	8S	8N	6H
Micro	♂	(♂)?	(P)	(♂)	P
			♀	♂	

	6S	(358) 6N	6H	6	(359) 7H
Micro	(P) ♀	(P) ♀	(P) ♀	(P) ♀	P ♀

			(359)	(366)
	7 H	7 S	7N	14 S
Micr	(P)	(P)	(P) F	(♂) ?
	♀	♀		

	14N	16
Micro	(♂)	
	♂	

P = perfect (structurally, not functionally)
♂ = male
F = anthers darkened, apparently frosted
( ) = tentatively determined from unopened flowers

Opening Dates for Sugar Maple Buds from Lane Trees (In Laboratory)

	Collected	Opened
9 H	3/25/55	3/28/55
8 H	3/25/55	3/28/55
7 H	3/25/55	3/28/55
6 H	3/25/55	3/28/55

DEPARTMENT OF FORESTRY

MEMORANDUM

Date 3/29/55

To

Pollination operations on sugar maple trees in lane - Bagging on tree #6 2:00 - 3:30 P.M. Approximately 40 bags (20 each of cloth and parchment varieties) were placed over blossom buds on the limbs in the lower and middle portions of the crown of tree #6. Non absorbent cotton was wrapped around the base of each twig and the mouth of the bag closed around it. Both cotton and bag were secured with "Twist-Ems".

(Signature)

3/28/55

3:00 P.M. Collection of Sugar Maple Branches for Pollination Work

Two branches were selected from each of nine trees (numbers 6-14), one from the south and one from the north side. These were cut from the limbs in the lower portions of the crown. They are arranged in flasks, the numbers on which indicate the tree from which they were selected. (6N = branch from north side of tree #6)

3/28/55 9:00 A.M. Branches were selected from each of four trees (numbers 6-9) from the south side of the tree and from limbs located in the upper portions of the crown. They are arranged in flasks, the numbers on which indicate the tree from which they were selected (6H = branch from upper limb of tree #6)

3/25/55 3:00 P.M - Branches were selected from each of four trees (numbers 6-9) from the south side of the tree and from limbs located in the upper portions of the crown. They are arranged in flasks, the numbers on which indicate the tree from which they were selected. 6H = branch from upper limb of tree #6

3/29/55 10:00 AM Branches were selected from each of three trees (numbers C, 4, and 6) from limbs in the lower and middle portions of the crown. They are arranged in flasks, the numbers on which indicate the tree from which they were selected (C = branches from lower and middle limbs of tree C)

Collection of Sugar Maple Branches for Pollination Work

3/30/55 9:30 A.M. Branches were selected from tree #8, from the lower and middle portions of the crown on the south and east sides. Branches were placed in a beaker of water on which the tree number has been marked.

FLOWERING - APRIL 19, 1955

4-19-55

Tree no	?♀ Condition of ♂ flowers	?♂ Condition of ♀ flowers
6 -	Fully developed & withered wings of seed developing	absence of pollen on nearly all of tree some immature anthers.
7 -	wings of seeds coming out no mature pistils left.	no pollen in anthers
8 -	Some mature females in upper reaches of tree	mature & immature pollen on tree; other anthers have no pollen
10 -	developed & old pistils a few immature also	mostly no pollen in anthers - some immature anthers
14 -	couldn't locate females on this tree	no pollen in anthers
16 -	developed & old pistil some immature	old anthers & some immature & mature anthers

4/9/55. First pollinations of lane trees (Tree #6). Relatively few flowers ready for pollination. Other trees not quite ready.

4/10/55. A few pollinations (Sunday P.M.). Most trees still not ready.

4/11/55. Further collection of branches for forcing. Branches from trees #4, 8, 10, and C. No pollination work. Some rain in afternoon.

4/12/55. Controlled pollinations all day, all trees, lower branches only in A.M. Upper branches in #6 in P.M. Pollen from trees 4 and 10 mainly; a little from #8.

Monday apr. 4 – put bags on trees and clipped twigs in the afternoon

reported for work in the morning

Tuesday – apr 5 bagged trees and began weeding of maple beds in nursery.

Wed. apr 6 – weeding maple beds.

Work accomplished thus far this week

George W. Mercer
4-7-55

Condition of Buds on Sugar Maples along Roadway 10:45 A.M.

3/30/55

Tree #	
E	Buds swollen
D	Buds beginning to swell
C	Buds swollen
B	No buds swollen
A	" " "
1	" " "
2	Buds beginning to swell
3.	Buds swollen (scattered)
4.	Buds beginning to swell
5	" " " "
6	Buds swollen
7	" "
8	" "
9	" "
10	" "
11	" "
12	" " (scattered)
13.	" "
14	" "
15	Few buds swollen
16	Buds swollen
17	" "
18	No buds swollen

3/25/55
3:00 PM

Condition of Buds on Sugar Maples along Roadway

Tree E - Buds beginning to swell

" D - " " " "

" C - Buds swollen

" B - No buds swollen

" A - " " "

" 1 - " " "

" 2 " " "

" 3 Buds beginning to swell

" 4 " " " "

" 5 " " " "

" 6 Buds swollen

" 7 " "

" 8 " "

" 9 " "

" 10 " "

" 11 " "

" 12 " "

" 13 " "

" 14 " "

" 15 Buds beginning to swell

" 16 Buds swollen

" 17 " "

" 18 No buds swollen

Stage of Flowering
Lane Sugar Maples

April 19, 1956

	Stage of flowering		Where
Tree #1	#2	beginning to swell	seems to be on most branches.
" #2	#2	beginning to swell	swelling is on most branches.
" #3	#2	beginning to swell	swelling is on most branches.
" #4	#2	beginning to swell.	predominent on S side but some on N.
" #5	#2 & 3	beginning & swollen	North side and near top are swollen - S side beginning
" #6	#3	swollen.	S. S. further along than N.S.
" #7	#3	swollen	appears to be fairly uniform over tree
# #8	#2 & 3	beginning & swollen	N.S. has scattered swellings, S.S. good % swelling.
# #9	#3	swollen	NS is budding very well S.S. a bit slower.
" #10	#3	swollen.	swelling is quite uniform over tree
" #11	#2 & 3	beginning & swollen	N.S. just beginning to swell. SS has a few clusters of quite large ones scattered over SS of tree
" #12	#3	swollen.	Swelling is about the same over tree
" #13	#3.	swollen	conformity is the rule - this tree is quite uniform all over.
# 14	#3.	swollen -	SS appears to be further along the N.S.
# 16	#2	beginning to swell	NS is a little further ahead.
# 19	#1 & 2	Some starting	N.S is dorment So is S.S except for a few scattered places in S.E. corner.
# 20	#1	dorment.	The whole tree appears dormant
#21	#2 & 3	beginning & swollen	NS is beginning & SS is quite far along

Stage of Flower Development
of Lane Sugar Maples
April 23, 1956

No leaves developed yet

Tree # 6 farthest along - a few buds opening out in sausage bags
10 also well developed
9 buds swollen some
12 buds not swollen much
4 beginning to swell

(No flowers fully out, practically none showing out of bud scales)

Tree #1 6 – (stratified 9/30)

Date poll	sex	cross	bag	date coll.	no. seeds	seed cond.
4/12		6X10	C	9/13	no seed	
4/12		6X4	P	9/12	45	dry,
4/12		6X10	P	9/12	38	OK
4/14		6X6 self poll	?	9/12	18	dry
4/14		6X4	C	9/12	20	dry
	stratified 10/1					
4/19		self poll	P	9/12	4	dry
4/12		6X10	T	9/13	50	dry,
4/12		6X4	C	9/12	40	2/3 ok
4/12		un	P	9/9	26	dry,
4/12		6X4	C	9/9	1	OK
4/12	♀ ♂	un	C	9/9	44	dry
4/14		6X8	C	9/9	22	dry
4/12		6 un	C	9/12	14	dry
5/3		open poll	?	9/12	28	dry
4/10		6X4	C	9/9	91	OK
4/10		6X4	P	9/9	118	dry
4/12		6X4	P	9/9	30	dry,
4/12		un	P	9/9	24	dry
4/12		6X10	P	9/9	46	dry,
4/12		6X4	P	9/9	112	dry
5/3		open poll	?	9/9	83	dry.
4/12	♂ ♀	un	S	9/9	22	dry
4/10		6X4	S	9/9	37	dry
4/12		6 un	C	9/12	14	dry

Tree # 6 - (stratified 9/30)

Date poll	sex	cross	bag	date coll.	no seeds	seed cond.
5/3		open poll	?	9/12	13	dry
5/3		open poll	?	9/12	30	OK
4/12		6 X 4	S	9/9	8	dry
4/10		6 X 4	S	9/9	60	dry
	(stratified 10/3)					
4/12		6 X 10	P	9/9	28	dry
4/9		6 X 10	S	9/9	38	dry
4/10		6 X 4	C	9/9	68	1/3 OK
4/12		6 X 10	C	9/9	6	dry
4/14		6 X 8	P	9/12	no seed	
4/10		6 X 4	S	9/9	no seed	
4/12		6 X 10	C	9/9	no seed	
4/12		un	C	9/9	no seed	
4/12		4 X 4	P	9/12	16	OK
4/12		6 X 4	C	9/12	36	dry
5/3		open poll	?	9/12	12	dry
4/12		6 X 10	S	9/12	84	OK
4/12		6 X 10	C	9/12	36	dry
4/12		6 X 4	P	9/12	46	dry
4/12	♂ ♀	un	S	9/12	17	dry
4/12		4 X 16	?	9/12	9	dry
4/12	♂ ♀	4 un	P	9/12	27	dry
4/12		6 X 4	C	9/12	55	dry
4/12		16 X 10	P	9/12	58	dry
4/12		6 X 4	P	9/12	70	OK

[Tr]ee # 6 - (stratified 10/3)

Date Poll	Sex	Cross	Bag	Dat Coll.	No. Seeds	Seed Cond.
4/12		6x4	C	9/12	68	OK
–	–	–	S	9/9	18	dry
4/14		Self poll	C	9/12	22	OK
4/19	♂ ♀	6 un	C	9/12	86	dry
4/12		6x4	P	9/12	30	dry
4/10		6x4	C	9/12	no seed	
4/12		6x10	C	9/12	55	dry
4/14		6x8	P	9/12	14	dry
4/12		un	P	9/12	38	OK
4/12		6x4	C	9/12	158	OK (mostly)
4/12		6x10	C	9/12	46	dry
—			P	9/12	14	dry
4/12		6x4	C	9/12	37	dry
(stratified 10/4)						
4/12	♂ ♀	6x10	S	9/12	16	dry
4/14		6x8	C	9/12	70	OK
4/12		6x10	P	9/12	56	dry
5/3		open poll	?	9/12	60	OK
4/14		6x8	C	9/12	26	dry
5/3		open poll	?	9/12	20	dry
4/14		6x8	P	9/12	12	dry
4/14		6x8	C	9/12	16	dry
4/14		6x6 self poll	?	9/12	37	dry
4/14		self poll	P	9/12	36	dry
4/14		6x8	C	9/12	10	dry
4/14		6x4	C	9/12	98	OK
4/12		6x4	C	9/12	70	dry
4/12		6x4	P	9/12	48	dry

Total 2794

[illegible]e # 7 (stratified 9/30)

Date Poll.	sex	cross	bag	Date coll.	No seeds	seed cond.
4/12		7x4	P	9/8	10	o.K.
4/12		7x8	P	9/7	2	dry
5/3		open poll	?	9/8	56	O.K.
4/12		7. un.	S	9/8	no seeds	
4/12		7x10	P	9/7	no seeds	
4/12		7x10	P	9/7	no seed	
4/12		7x4	P	9/8	no seed.	
4/12		7x4	C	9/7	4	OK
5/3		open poll	?	9/8	55	oK
5/3		open poll	?	9/8	10	oK
4/12		7x4	C	9/7	60	oK
5/3		open poll	?	9/7	31	OK
5/3		open poll	?	9/8		oK
4/12		7x10	P	9/7	44	dry
5/3		open poll	?	9/7	12	oK
4/12		7 un.	C	9/7	no seed.	
4/12		7x4	C	9/7	no usable seed	
4/12		7x4	P	9/7	no seed	
4/12		7x10	C	9/7	no seed	
4/12		7x4	P	9/7	no seed	
4/12		7x10	P	9/7	14	oK
4/12		7x4	C	9/7	32	oK
4/12		7x4	C	9/7	62	dry
5/3		open poll	?	9/7	42	oK
4/12		7x4	P	9/7	8.	½ oK

Tree #7 (stratified 9/30)

Date Poll.	sex	cross	Bag	Date coll.	No. seeds	seed cond.
4/12		7 X 10	C	9/7	7	O.K.
5/3		open poll	?	9/7	24	OK
5/3		open poll	?	9/9	41	OK
				Total	508	

Tree #8 - (stratified 9/29)

Date Poll.	sex	Cross	Bag	Date Coll	No. Seeds	9/28 Seed Condition
4/19		8 x 4	S	9/9	no seeds	
—	—	—	P	—	no seeds	
—	—	—	S	—	27	dry
4/19		8 x 8	C	9/8	56	dry
5/3		self poll.	?	9/8	6	dry
4/19	♂ ♀	8 - un.	S	9/8	9	dry
5/3		open poll.	?	9/8	35	dry
4/19		8 x 4	C	9/8	132	dry
5/3		self poll	P	9/8	no seeds	
4/19	♂ ♀	8 x 4	P	9/8	34	dry
4/19	♂ ♀	8 x 4 small amt. pollen	C	9/8	56	dry
5/3		open poll	?	9/8	51	dry
5/3		self poll	?	9/9	83	dry
—		—	S	—	66	dry
4/19		8 x 8 (selfed)	P	9/8	14	dry
5/3		self poll.	C	9/8	37	dry
5/3		self poll	?	9/8	25	dry
5/3		self poll	?	9/8	19	dry
4/19	♂ ♀	8 - un	P	9/8	93	dry
		—	P	—	85	dry
5/3		open poll	?	9/8	114	dry
5/3		open poll	?	9/8	97	dry
			C		35	dry
			S		68	dry
5/3		self poll	S	9/8	0	

Tree # 8

Date Poll.	sex	cross	Bag	Date Coll.	No. seeds	Seed condition
4/19	♂ ♀	8 - un	C	9/8	103	dry
4/12		8 × 8	P	9/8	45	dry
			C		84	dry
5/3		open poll	?	9/8	50	dry
5/3		self poll	P	9/8	8	dry
			C	9/8	66	dry
4/19	♂ ♀	8 × 4	C	9/8	84	dry
5/3		self poll	?	9/9	98	dry
5/3		self poll	?	9/8	12	dry
5/3		self poll	?	9/9	42	dry
				Total	1718	

Tree #10 - (Stratified 9/29)

Date Poll.	Sex	cross	Bag	Date Coll.	No. seeds	seed cond.
5/4		open poll.	?	9/9	100	O.K.
5/4		open poll	?	9/9	53	dry
5/4		open poll	?	9/9	62	OK
4/12		10 x 10	C	9/9	no seeds	—
4/12		10 X 10	S	9/9	16	dry
4/12		10 x 10	S	9/9	43	dry
4/14		10 X 4	S	9/9	no seed	
4/12	♂ ♀	10-un	P	9/9	124	dry
4/12	♂ ♀	10-un	C	9/9	103	dry
5/4		open Poll	?	9/9	41	dry
4/12	♂ ♀	10-un	S	9/9	58	dry
5/4		open poll	?	9/9	94	dry
4/12	♂ ♀	10 un	S	9/9	86	dry
4/12	♀ ♂	10-un	S	9/9	70	dry
4/12		10-un	C	9/9	62	dry
			S	9/9	77	½ OK
4/14		10 x 4	P	9/9	50	dry
				Total	1639	

Tree # 16 - (stratified 9/30)

Date Poll	sex	cross	Bag	Date Coll.	no. seeds	seed cond.
			P	9/8	4	dry
4/15		16 x 4	P	9/8	16	OK
			S	9/8	no seeds	
			C	9/8	no seeds	
4/15		16 x 14	C	9/8	18	OK
4/15		16 x 8	C	9/8	25	OK
4/15		16 x 4	C	9/8	16	½ OK
4/15		16 x 4	S	9/8	4	dry
5/4		open poll	?	9/8	8	OK
5/4		open poll	?	9/8	18	OK
5/4		open poll	?	9/8	32	OK
5/4		open poll	?	9/8	6	OK
4/15		16 x 4	C	9/8	13	OK
4/15		16 x 4	C	9/8	13	OK
5/4		open poll	?	9/8	6	OK
4/15		16 x 8	P	9/8	16	dry
					Total 197	

x	No of Measurements	Stem Height Total	Stem Height Aver.	Leaf Length Total	Leaf Length Aver.
6x4	131	604.3	4.6	507.9	3.9
6x4	10	43.3	4.3	40.7	4.1
6x10	28	121.9	4.4	116.7	4.2
6x6-self	10	42.6	4.3	38.3	3.8
6-un	18	74.1	4.1	57.3	3.2
6-open	35	152.1	4.3	132.6	3.8
7x4	22	128.7	5.8	99.2	4.5
7x10	7	42.1	6.0	38.4	5.5
7x7-self	2	4.6	2.3	2.2	1.1
7-un	—	—	—	—	—
7-open	64	339.1	5.3	284.6	4.4
8x4	12	37.6	3.1	34.9	2.9
8x8-self	13	40.5	3.1	37.8	2.9
8-un	4	11.7	2.9	9.9	2.5
8-open	11	35.2	3.2	34.6	3.1
10x10-self	10	44.9	4.5	36.2	3.6
10-un	32	132.5	4.1	110.0	3.4
10-open	65	301.5	4.6	266.3	4.1
16x4	12	64.4	5.4	52.7	4.4
16x8	3	12.9	4.3	12.1	4.0
16x14	6	37.5	6.2	31.3	5.2
16-un	—	—	—	—	—
16-open	54	259.1	4.8	223.1	4.1
Tree 6	11	49.0	4.4	47.9	4.4
Tree 4	7	21.1	3.0	18.6	2.6
10-Shag	10	35.2	3.5	36.0	3.6
Total	577	2635.4	4.61	2269.3	3.9

Height Total	No.	Total	Aver.
Cross	231	1092.7	4.7
Self	35	132.4	3.8
Open	229	1046.7	4.7
Un	54	218.3	4.0
Misc.	28	105.3	3.8
	5		
	577	2572.7	4.2
Length			
Cross	231	993.9	4.3
Self	35	114.5	3.3
Open	229	941.2	4.1
Un	54	177.2	3.3
Misc	28	102.5	3.7
	577	2329.3	3.7

	aver. Height	aver. Length
Cross	4.7	4.3
Open	4.7	4.1
Misc	3.8	3.7
Un	4.0	3.3
Self	3.8	3.3

LAST 6 FLATS PLANTED NOS. 77 —, 85, 60, 92, 81

First 5 flats 83, 78, 49, 64, 48

	No of Measured	Height Total	Aver.	Length Total	Aver.	No	Height Total	Aver	Length Total	Aver
6x4	62	254.9	4.1	204.5	3.3	55	283.2	5.1	246.6	4.5
6x10	4	10.2	2.6	10.0	2.5	14	62.7	4.5	64.1	4.6
6-self	3	14.1	4.7	11.7	3.9	4	16.2	4.0	17.7	4.4
6-open	15	53.1	3.5	39.1	2.6	13	69.3	5.3	64.8	5.0
6-line	8	29.6	3.7	19.4	2.4	10	44.2	4.4	41.9	4.2
10-self	1	2.9	2.9	1.7	1.7	5	28.6	5.7	21.7	4.3
10-open	4	14.7	3.7	10.1	2.5	42	213.6	5.1	196.0	4.7
10-line	4	19.0	4.8	9.5	2.4	20	84.0	4.2	77.8	3.9
7x4	4	15.5	3.9	11.9	3.0	9	60.9	6.7	45.8	5.1
7x10	1	2.8	2.8	1.3	1.3	4	28.3	7.1	25.5	6.4
7-self	2	4.6	2.3	2.2	1.1					
7-open	13	49.1	3.8	30.8	2.4	22	117.1	5.3	116.6	5.3
8x4	3	7.5	2.5	5.2	1.7	2	7.1	3.6	7.4	3.7
8-self	3	6.4	2.1	5.6	1.9					
8-open	1	3.9	3.9	3.0	3.0	2	5.5	2.8	5.5	2.8
8-line	2	4.7	2.4	2.5	1.2					
True 8	1	2.4	2.4	1.1	1.1					
16x4	2	10.0	5.0	9.4	4.7	5	27.7	5.5	23.4	4.7
16-open	21	87.7	4.2	65.3	3.1	9	56.6	6.3	55.3	6.1
6x4						5	21.9	4.4	21.2	4.2
5 by 10						4	15.8	4.0	17.1	4.3
16x8						2	9.1	4.6	8.3	4.2
16x14						6	37.5	6.2	31.3	5.2
	154	593.1	3.8	444.3	2.9	233	1189.1	5.1	1088.0	2.7
Cross	76	300.9	4.0	242.3	3.2	102	538.2	5.3	473.6	4.6
Open	54	208.5	3.9	148.3	2.7	88	462.1	5.2	438.2	5.0
Self	8	28.0	3.5	21.2	2.6	9	44.8	5.0	39.4	4.4
Line	14	53.3	3.8	31.4	2.2	30	128.2	4.3	119.7	4.0
Mixed	1	2.4	2.4	1.1	1.1	4	15.8	4.0	17.1	4.3

UNIVERSITY OF NEW HAMPSHIRE
DURHAM, NEW HAMPSHIRE

AGRICULTURAL EXPERIMENT STATION

May 8, 1953

Mr. Howard Kriebel
Yale School of Forestry
205 Prospect Street
New Haven 11, Conn.

Dear Mr. Kriebel:

I have delayed answering your letter because I have been trying to trace the name and address of the company which manufacturers the nylon cloth that we use in pollination work. I have not beenable to locate this information but I believe that I am correct in saying that you should write to the X. Smith Corp., Box 272, Red Bank, New Jersey. This address (minus the name) is on the back of the bag in which the cloth was sent to me. I am forwarding a sample of this cloth in a separate envelope.

In order to make bags of this cloth we have folded in the edges a couple of times and stapled them together. This has made an effective barrier to insects in our fruit tree experiments.

Very truly yours,

L. P. Latimer

L. P. Latimer
Associate Horticulturist

LPL/s

Measured 3/14-17/56

INITIAL GROWTH MEASUREMENT OF SEEDLINGS - 1956

Cross	No. measure-ments	Total Height	Mean Height	Total Length	Mean Length					
6 x 4	131	604.3	4.6	507.9	3.9					
6 x 8	10	43.3	4.3	40.7	4.1					
6 x 10	28	121.9	4.4	116.7	4.2					
6 - self	10	42.6	4.3	38.3	3.8					
6 - un	18	74.1	4.1	57.3	3.2					
6 - open	35	152.1	4.3	132.6	3.8					
Tree 6 Tree 6	11	49.0	4.4	223.1	4.1					
7 x 4	22	128.7	5.8	99.2	4.5					
7 x 10	7	42.1	6.0	38.4	5.5	6				
7 - self	2	4.6	2.3	2.2	1.1	2				
7 - open	664	339.1	5.3	284.6	4.4	58				
8 x 4	12	37.6	3.1	34.9	2.9	10				
8 - self	13	40.5	3.1	37.8	2.9	12				
8 - un	4	11.7	2.9	9.9	2.5	4				
8 - open	11	35.2	332.6	334.6	3.1	10				
Tree 8	7	21.1	3.0	18.6	2.6	6				
10- self	10	44.7	4.5	36.2	3.6	10				
10 - un	32	132.5	4.1	110.0	3.4	28				
10 - open	665	301.2	4.6	266.3	4.1	58				
10 - s bag	10	35.2	3.5	36.0	3.6	10				
16 x 4	12	64.4	5.4	52.7	4.4	10				
16 x 8	3	12.9	4.3	12.1	4.0	3				
16 x 14	6	37.5	6.2	31.3	5.2	5				
16 - open	54	259.k	4.8	223.1	4.1	48				
Total	577	2635.4	4.6	2269.3	3.9					
Cross	231.	1092.7	4.7	993.9	4.3					
Self	35	132.4	3.8	114.5	3.3					
Open	229	1086.7	4.7	941.2	4.1					
Un	54	218.3	4.0	177.2	3.3					
Miscellan.	28	105.3	3.8	102.5	3.7					

m 5919

Please return to Mr Kriebel

THE VISKING CORPORATION

HOME OFFICE

VISKING ®

CABLES: SYNTH-CHICAGO CODES: BENTLEY-ACME

6733 WEST SIXTY-FIFTH STREET, CHICAGO 38, ILLINOIS

TELEPHONES: RELIANCE 5-1234 LONG DISTANCE SUMMIT 1300

April 14, 1953

Yale School of Forestry
205 Prospect Street
New Haven 11, Connecticut

Attention: Mr. H. B. Kriebel

Gentlemen:

In accordance with your request we are enclosing our current price list on Visking cellulose seamless tubing.

Since you are particularly interested in 1-5/8 and 2-1/4 inch diameters, we are enclosing samples of our 1-5/8 and 2-1/4 Standard Stretch cellulose tubings.

Shipment can usually be made within ten days after receipt of your written order.

We appreciate your interest in our products and look forward to serving you.

Yours very truly,

THE VISKING CORPORATION

O. L. Gohr

O. L. GOHR
DIVISION OF SPECIAL SERVICES

OLG:ep

Enc.

CP Sugar Maple Seedlings

Heights as of 23-10-1959.

362	OPEN.	61. 50. 88. 56. 85
X 359	"	80. 112. 181. 169. 112. 138. 172. 87. 30. 17. 82. 156. 122. 159. 137
368	"	49. 95. 226.
360	self	134. 52. 41.
360	un.	181. 119
362	OPEN	140. 156. 114. 193. 298. 16. 65. 135. 52. 88. 133. 108.
368	× 356.	178. 163. 50. 103.
368	OPEN	177. 56. 105. 148. 187. 15. 77. 91. 3.4. 47. 123. 63. 74. 89. 39. 2.
360	OPEN	193. 10. 15
	UN.	114.
362	UN	100.
362	self.	14.
360	× 356	29. 33. 47.
359	× 362	169.
360	—	15. 84.
368	× 366.	75.
359	OPen	118. 57. 80. 76. 46. 47. 76. 11. 20. 28
358	× 356	13. 66. 35. 35. 22. 15. 16. 30. 16. 30. 36. 45. 45. 32. 20. 62. 79. 140. 60. 109
358	× 362	28. 18. 17. 28. 18. 85. 67. 68.
359	× 356	33. 43. 63. 26. 111. 107. 96. 133. 118. 130. 101. 15
358	UN	48. 48.
		15.
358	OPEN	32. 54. 102. 45. 61.
358	× 358	71.
Tree 6.		68.
358	× 356	149. 129. 89. 138. 83. 167. 145. 48. 82. 22. | 83. 97. 92. 60. 70. 61. 84. 67
358.		84.
358	self.	127. 70.

81

146.

HEIGHT OF PROGENIES, CM.
SEPT. 12, 1957

Bed A

	6 x 4	6x4	6 x10	6 Self	6 Un	6 Open	7x4	Tree 6
	51	62	13	49	25	14	8	18
	14	39	16		12	26	7	22
	36	23	55			17	7	52
	6		6			32	42	
	13		6			40	17	
	48		5			18	33	
	23		16			31	6	
	5		16				58	
	45		3				26	
	10		14				7	
	7						50	
	5							
	30							
	9	~~6x10~~						
	25							
	37							
	62							
3 rows from north	61							
	11							
	15							
	12							
	45							
	19							
	34							
	11							
	44							
	26							
	44							
	56							
	12							
	37							
	6							
	35							
	27							
	51							
	24							
	37							
	26							
	16							
	9							
	27							
	14							
	35							
	46							
	6							
	4							

9/12/57

Bed B

16 open	16 x14	10 self	16 x 4	10 open	8 open	10 Un	10 Self	Tree 8	8 x 4	8 self
22	58	9	44	49	7	6	6	16	10	18
2			68	12	33			7	20	6
28			25	11	68				21	3
35			24	9						30
33			14	5						
24				63						
20				14						
10				7						
56				36						
15				10						
74				9						
19				54						
19				27						
35				26						
9				10						
44				50						
31				10						
8				23						
22				14						
24				16						
				22						
				34						
				6						
				70						
				76						
				13						

/ / / Bed B

8 Un	7 open	7 x 10	7 self
14	40	41	—
6	38	4	
63	40		
49	38		
	59		
	14		
	30		
	33		
	40		
	17		
	7		
	50		
	90		
	11		
	17		
	45		
	52		
	18		
	38		
	45		
	29		
	33		
	5		
	20		
	46		
	20		
	12		
	7		
	17		
	60		
	7		

SUGAR MAPLE - 1955 CP SEEDLINGS
Height in Cm. 9/26/56

	6x4.	R4. 6x4	6x10	6UN	6. OPEN	7x4	TREE 6.	6. self.
R 1	5-	6.2	7.5	4-	10-	8.5	6	14.6
	2.5	6-	5-	3-	6-	5.2	5.7	9-
	19.5	6.5	4.5	3-	(58) Poll.	5-	15.1	
	5.4	12-	8.8	6.5	5-	4.7	6.3	
	8-	5-	6-	10-	6-	5.6	7.5	
	10.2	15-	2-	1.5	7-	12-	4.6.	
	4.5	7-	3.5		10.5	5		
	5.5	12-	4.8		8.6	26.1		
	5.9	7.8	10-		7-	11-		
	18.3	9	4		6-	3.4		
	14-	8.6	4		6-	4.7		
	35.9	6-	3.5		5-	10.5		
	3.5	7-			5-			
	3.5	8-			4.8			
	18-	4.3			12-			
	3.8	7.3			17.9			
R 2.	17-	16.5			6-			
	7.2	4.8			7.7			
	2.6	7.2			6.5			
	20.5	3-			5-			
	12-	20-			4-			
	9.2	11-						
	3.5	6-						
	4.2	Tot. 582	Tot. 65	Tot. 28	Tot. 141			Tot. 24
	4-	Mean = 8.6	Mean = 5.4	Mean = 4.7	Mean = 7.3			Mean 12.0
	5.9							
	4.3							
	4.5							
	3-							
	4.1							
	10-							
R 3.	5-							
	6.5							
	4.5							
	13-							
	11.4							
	6-							
	17.6							
	3.5							
	24.5							
	5.2							
	4.5							
	3.5							
	4.2							
	4.7							

	✓	✓		✓	✓	✓	✓	✓	✓
R 1	7.OPEN	8.OPEN	10.OPEN	8.UN	8.SELF	8 X 4	10.UN	10.SELF	TREE.8
	5.8	4	19 -	38 -	9 -	10 -	6.5	7.5	9.5
	13 -	16.2	50 -	29 -	4 -	4 -	1	3 -	4 -
	5.2	12 -	6 -	26 -	3 -	9 -	3.5		
	1.8	5 -	11 -	4 -	6 -		3.5		
	7	9.5	10 -		1 -		4 -		
	4.5		5 -		6 -		3 -		
	12 -		2 -		6.5				
	2 -		3 -		5 -				
	17.4		15 -						
	7.5		6 -						
	10 -		5 -						
	2.5		3.5						
	10.3		5 -						
	8.9		14 -						
	3 -		6.5						
R 2.	8 -		3 -						
	5 -		5 -						
	8 -		3 -						
	7.5		2 -						
	10.8		12 -						
	6 -		4 -						
	9 -		4 -		Tot. 40		Tot. 22	Tot. 11	
	9 -		3.5		Mean 5.0		Mean = 3.7	Mean 5.5	
	8.9		5.5						
	7 -		9 -				✓		
	14.2		8 -						
	7.5		9 -						
	9.2								
	10.5								
	9.3								
	7 -								
	21 -								
	6 -								
	8.8								
	5.2								
	11.3								
	15 -								
	5 -								
		Tot. 47	Tot 230						
		Mean 9.4	Mean 8.5						

✓ 16 X 4	10.SbEW	16.OPEN
5 -	4. -	9 -
11 -		4 -
6 -		4 -
6 -		12 -
8.5		8 -
14 -		13.5
6 -		5.5
13 -		3 -
7 -		6 -
7.2		6.2
		4.5
		7 -
		4.5
		7 -
		7 -
		5 -
		5 -
		8 -
		7.2
		3.5
		7.3

⊠ indicates broken or cut off.

West Bed →

East Bed →

Yingst 7/16/57

West Bed

6 × 4
50, 28, 4, 12, 46, 20, 4, 6, 4, 29, 7, 19, 36, 62, 66, 29, 9, 56, 44, 42, 8, 25, 18, 43, 11, 14, ⊠ 2, 4, 32, 26, 49, 35, 25, 8, 7, 27, 7, 34, 45, 4, 3, 21, 68
25.3
~~[illegible]~~
1089
~~1085~~

6 × 4
25, 22
23.5

6 × 8
NONE

6 × 10
13, 14, 16, 4, 5, 5, 50, 14, 13
14.9

6 SELF
45
45

6-UN
11, 24
17.5

6 OPEN
12, 22, 16, 31, 38, 16, 29, 8, 5
19.7

7 × 4
40, 15, 33, 55, 25, 4, 48
31.4

"TREE 6"
13, 9, 46
22.7

East Bed

7 × 10
50, 39
44.5

7 Self
NONE

7 OPEN
37, 40, 27, 32, 19, 39, 25, 17, 12, 6, 16, 8, 40, 37, 27, 39, 26, 50, 10, 29, 33, 38, 14, 49, 76, 11, 15, 48, 49
~~30.5~~
30.0
~~884~~
869

8 × 4
8, 19
13.5

8 Self
18, 4, 3, 29
13.5

8-UN
14, 6, 57, 44
30.2

8 OPEN
30, 66, 5
33.7

10 SELF
3
3

"TREE 8"
⊠ 15, 6
10.5

10 UN
34, 9
21.5

10-OPEN
16, 7, 42, 10, 7, 4, 45, 9, 6, 25, 8, 46, 25, 9, 9, 33, 7, 14
18.0

10-S-beg
8
8

16 × 4
11, 22, 25, 66, 41, 56
36.8

16 OPEN
1, 9, 6, 49, 10, 53, 17, 17, 29, 18, 14, 4, 18, 21, 17, 15, 33, 34, 27, 20
20.6

16 × 8
NONE

INSTRUCTIONS FOR MAPLE SEEDLING LISTS

Facing the front of the labels in flats, read from left to right. Begin at end nearest; always return to the left ~~##~~ beginning ~~##~~ each row.

No. on record of planted seeds indicates number of consecutively planted seeds of same cross, bagging, and collection dates and from same tree.

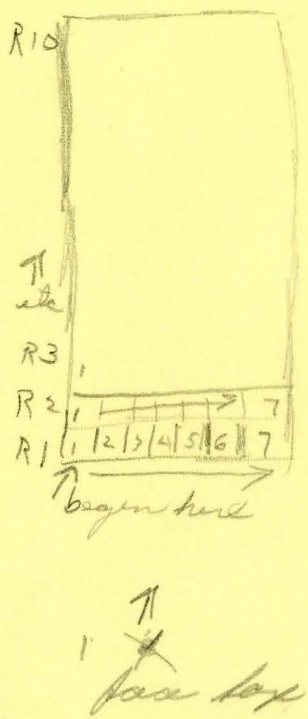
Ex.	Row 1			No.
	6 x 4 - C	4/12	9/9	3
	6 x 4 - S	4/10	9/9	4
		Tree 6 above		

This means, the first three seeds in Row 1 are of the cross 6 x 4 - C; the last four, cross 6 x 4 - S.

"Tree 6 above" shows that everything listed above was taken from the box "Tree 6."

The flat number listed on the record is the one found on side of flat.

The date directly to the right of this indicates the date planted. (On record)



Flat number 83 (In order of planting) 1/23/56

	Bagged	seedling height	Collected	Leaf length	No.
Row 1					
16 x 4 - C	5/14		9/8		1
Open Poll.	5/14		9/8		1
16 x 8 - P	4/15		9/8		1
Open Poll.	5/4		9/8		4
Row 2					
16 x 4 - C	4/15		9/8		2
16 x 8 - C	4/15		9/8		2
16 x 4 - C	4/15		9/8		2
16 x 14 -P (c)	4/15		9/8		1
Row 3					
Open Poll.	5/14		9/8		2
16 x 14 - C	4/15		9/8		3
16 x 14 - P (c)	4/15		9/8		2
Row 4					
Open Poll.	5/14		9/8		2
		Tree 16 above			
10 x 10 - S	4/12		9/9		4
Open Poll.	5/14		9/9		1
Row 5.					
Open Poll.	5/14		9/9		7
Row 6					
Open Poll.	5/14		9/9		1
10 - Un - S ♀♀	4/12		9/9		6
Row 7					
10 - Un - S ♀♀	4/12		9/9		3
10 - Un - P. ♀♀	4/12		9/9		2
Opem Poll.	5/14		9/9		2
Row 8					
Open Poll.	5/14		9/9		7
Row 9					
Open Poll.	5/14		9/9		7
Row 10					

Flat number 83 (Cont.)

Row 10	Bagged	Seedling height	Collected	Leaf length	No.
Open Poll.	5/14		9/9		7

Flat 78 1/23/56

	Bagged		Collected		No.
Row 1					
Un - 10 - C	4/12		9/9		7
Row 2					
Un - 10 - C	4/12		9/9		2
Open Poll.	5/4		9/8		1
9 x 4 - P	4/4		9/9		1
10 - Un - S ♀♀	4/12		9/9		1
10 - Un - S	4/15		9/9		1
10 - Un - S ♀♀	4/12		9/9		1
Row 3					
10 - Un - S ♀♀	4/12		9/9		3
Open Poll	5/14		9/9		4
Row 4					
Open Poll.	5/14		9/9		7
Row 5					
Open Poll.	5/14		9/9		7
Row 6					
S bag			9/9		5
10 - Un - S	4/12	Tree 10 above	9/9		2
Row 7					
10 - Un - S	4/12		9/9		1
10 x 10 S	4/12	Tree 10 above	9/9		1
10 x 7 - P	4/12		9/7		1
7 x 4 - C	4/12	3 1/8	9/9	2 3/8	4
Row 8					
7 x 4 - C	4/12	3 1/8	9/9	2 3/8	1

Flat 78 Cont.

	Bagged	Collected	No.
Row 8 (cont.)			
7 x 10 - P	4/12	9/9	2
Open Poll.	5/7	9/9	4?
Row 9			
Open Poll.	5/7	9/9	3
Open Poll.	5/3	9/9	4
Row 10			
Open Poll.	5/3	9/9	5
7 x 4 - P	4/12	9/8	2
Flat 49 1/24/56			
Row 1			
7 x 4 - P	4/12	9/8	1
7 x 10 - C	4/12	9/7	1
Open Poll.	5/3	9/7	5
Row 2			
7 x 4 - C	4/12	9/9	3
Open Poll.	5/3	9/8	3
Tree 7 above			
6 x 6 - self	4/14	9/12	1
Row 3			
6 x 6 - self	4/14	9/12	4
6 - Un - C	4/19	9/12	1
6 - Un - S	4/19	9/12	1
6 x 4 - C	4/12	9/12	1
Row 4			
6 x 4 - C	4/12	9/ 12	3
Un - P	4/12	9/12	2
6 x 6 - self	4/14	9/12	1
6 x 4 - C	4/12	9/12	1
Row 5			
6 x 4 - C	4/12	9/12	5
6 x 4 - S	4/10	9/9	2
Row 6			
6 x 4 - S	4/10	9/9	3

Flat 49 (Cont.)

	Bagged		Collected		No.
Row 6 (cont.)		1 1/4, 2, 2 3/16, 2 7/16		1 3/8, 1 1/2, 1 10/16, 2	
6 - Un - C ♀♀	4/12		9/12		1
6 x 4 - C	4/10		9/9		2
6 x 4 - C	4/12		9/12		1
Row 7		1 3/4, 1 3/8, 1 3/4, 2 1/2, 2 1/8, 1 5/16		1 9/16, 1 5/8, 1 3/4, 2 1/16, 1 13/16, 1	
6 x 4 - P	4/12		9/12		7
Row 8		1 13/16, 1 3/4, 2 1/4, 1 9/16, 1 7/16, 1 7/8		1 7/8, 1 1/16, 2 1/4, 1 1/2, 1 1/2, 1 3/8	
6 x 4 - P	4/12		9/12		5
6 x 4 - C	4/12		9/9		2
Row 9		1 3/8, 1 1/2, 1 1/2, 2 1/8, 1 7/8, 2 9/16		1 1/16, 1 9/16, 1 9/16, 2 1/8, 1 9/16, 2 3/4	
10 x 6? - P	4/12		9/13?		3
6 - Un - S ♀♀	4/12		9/12		4
Row 10		1 3/8, 2 1/4, 2 1/2, 2 1/4, 1 5/16, 1 9/16, 2 5/8		1 1/2, 1 3/4, 2 9/16, 1 5/8, 1 1/2, 1 7/8, 1 3/4	
Open Poll.	5/3		9/12		4
6 - Un - S	4/12		9/12		1
Open Poll.	5/3		9/12		2
Flat 64 1/24/56					
Row 1		2 1/16, 3 1/8, 2 3/4		1 3/4, 1 3/16, 1 1/4	
6 x 4 - P	4/12		9/9		7
Row 2		2 5/16, 2 3/16, 2 5/16, 2 7/16		1 3/4, 2 1/16, 1 11/16, 1 7/8	
6 x 4 - P	4/12		9/9		1
6 x 4 - C	4/12		9/12		6
Row 3		2 1/8, 2 3/8		1 9/16, 1 13/16	
6 x 4 - C	4/12		9/12		7
Row 4		2 1/4, 2 1/16, 2 7/16		1 3/8, 1 7/16, 2	
6 x 4 - C	4/12		9/12		7
Row 5		2 1/2		2 1/4	
6 x 4 - C	4/12		9/12		2

Flat 64 (cont.)

	Bagged		Collected		No.
Row 5 (cont.)		1 1/2		1 1/4	
6 x 10 - P	4/12		9/9		1
6 x 10 - S	4/12		9/9		4
Row 6		1 3/4, 1 5/8		1 5/8, 1 7/16	
6 x 10 - S	4/9		9/12		7
Row 7		1 7/16, 1 1/2		1 11/16, 1 5/8	
6 x 10 - S ♀♀	4/12		9/12		3
6 x 8 - P	4/14		9/12		2
6 - Un - P ♀♀	4/12		9/12		2
Row 8		1 9/16, 2 1/4, 2 7/16		1 7/16, 2 9/16, 2 1/16	
Open Poll.	5/3		9/9		7
Row 9		1 1/2, 2 1/4, 1 7/8		1 3/4, 1 13/16, 1 11/16	
Open Poll.	5/3		9/9		1
6 x 4 - C	4/12		9/12		6
Row 10		2 7/16, 1 7/8, 2 3/8		2 5/8, 1 3/4, 2 3/16	
Open Poll.	5/3		9/12		3

Flat 48 1/25/56

	Bagged		Collected		No.
Row 1		2, 2 1/4, 2 1/2, 2, 1 9/16		1 7/16, 2 1/16, 2 7/16, 2 5/16, 7/8	
6 x 4 - P	4/12		9/12		3
6 x 10 - C	9/12		9/12		2
6 x 4 - P	4/12		9/12		2
Row 2		1 3/4, 2, 2 1/16, 2		1 11/16, 2 3/4, 2 3/8, 2 3/16	
6 x 4 - P	4/12		9/12		1
6 x 4 - C	4/12		9/12		1
Self Poll	4/14		9/12		1
6 x 10 - P	4/12		9/12		3
S bag			9/9		1
Row 3		2 1/8, 2 1/4		2 1/4, 1 11/16	
6 x 4 - S	4/12		9/9		1
6 x 8 - C	4/14		9/12		6

Flat #48 (Cont.)

	Bagged		Collected		No.
Row 4		2 1/4 2		2 3/4 1 1/2	
6 x 10 - P	4/12		9/12		5
6 x 8 - C	4/14		9/12		2
Row 5		2 7/8 2 1/8 2 1/8 2 1/4 2 1/4 2 3/8		2 1/8 2 1/8 2 1/8 2 7/16 2 1/8 2 1/16	
6 x 4 - P	4/12		9/12		7
Row 6		2 1/4 2 2 1/16 2 1/4 2 1/8		2 1/16 1 3/4 2 2 1/4 2 13/16	
6 x 4 - P	4/12		9/12		1
Tree# 6					3
6 x 4 - C	4/10		9/9		3
Row 7		1 1 3/4 1 7/16 1 7/8 1 15/16		15/16 1 1/2 1 3/4 1 3/4 1 7/8	
6 x 4 - C	4/10		9/9		1
6 x 10 - C	4/12		9/12		3
6 x 8 - C	4/14		9/12		1
6 x 8 - P	4/14		9/12		1
Open Poll.	5/3		9/12		1
Row 8		1 3/4 1 7/8 1 7/8		1 9/16 1 15/16	
Open Poll.	5/3		9/12		1
6 x 10 - P	4/12		9/12		1
Un - P	4/12		9/12		1
6 x 4 - C	4/12		9/12		4
Row 9		1 7/8 1 1/8 1 1/16		1 11/16 1 1/16 1 1/8	
6 x 4 - C	4/12		9/12		3
8 x 4 - C planted 1/30/56	4/19	Tree 6 above	9/9		4
Row 10		1 1/16 1 1/8		1 9/16	
Open Poll	4/12		9/8		6
8 x 8 - P	4/12	Tree 8 above	9/9		1

Flat 24 1/30/56

	Bagged		Collected		No.
Row 1		3 3/4 2 1/2 3 3/8 2 9/16 2 7/8 2 5/16		2 3/8 2 1/8 2 1/16 2 1/16 2 3/16 1 13/16	
Open Poll	5/3		9/7		2
7 x 4 - C	4/12		9/7		2
Open Poll	5/3		9/7		3

Flat 24 (Cont.)

	Bagged		Collected	No.
Row 2				
Open Poll.	5/3	Tree 7 above	9/7	7
Row 3				
8 x 4 - P	4/19	Tree 8 above	9/8	2
7 x 4 - C	4/12	Tree 7 above	9/7	5
Row 4				
Self Poll.	5/3		9/7	4
Tree 8			9/7	2
8 x 4 - P	4/19		9/8	1
Row 5				
8 x ~~5~~ 4 - C	4/19		9/8	3
Open Poll	5/3		8/9	3
Self Poll	5/3		9/9	1
Row 6				
8 - Un - P	4/19		9/4	1
Self Poll	5/3		9/9	4
8 x 5 - C	4/19		9/8	2
Row 7				
Tree 8			9/8	1
Open Poll.	5/3		9/8	2
8 - Un - P	4/19		9/8	4
Row 8				
Tree 8			9/8	7
Row 9				
8 x 4 - C	4/19		9/8	1
Open Poll	4/12		9/8	5
Tree 8			9/8	1
Row 10				
8 x 4 - C	4/19		9/8	3
8 x 8 - P	4/12	Tree 8 above	9/9	4

Flat 15 2/1/56

	Bagged	Collected	No.
Row 1			
Open Poll.	5/3	9/7	1
Open Poll.	5/3	9/9	4
Open Poll.	5/3	9/7	2
Row 2			
7 x 4 - P	4/12	9/7	1
7 x 4 - P	4/12	9/7	1
Open Poll.	5/3	9/8	5
Row 3			
Open Poll.	5/3	9/7	5
7 x 10 - P	4/12	9/7	2
Row 4			
7 x 4 - P	4/12	9/8	2
Tree 7 above			
Open Poll.	5/4	9/9	5
P 5			
Open Poll.	5/4	9/9	7
Row 6			
Open Poll.	5/4	9/9	7
Row 7			
Open Poll/	5/4	9/9	4
Open Poll.	5/4	9/9	3
Row 8 planted 2/2			
Open Poll.	5/4	9/9	6
Open Poll.	5/4	9/8	1
Row 9			
Open Poll.	5/4	9/98	2
16 x 4 - C	4/15	9/8	1
16 x 8 - C	4/15	9/8	1
16 x 4 - C	4/15	9/8	1
Open Poll.	5/4	9/9	2
Row 10			
Open Poll.	5/4	9/8	1
16 x 4 - P	4/15	9/8	3
Open Poll.	5/4	9/8	2
16 x 4 - C	4/15	9/98	1

Tree 16 above

Flat 9 2/2/56

	Bagged	Collected	No.
Row 1			
16 x 4 - C	4/15	9/8	1
16 x 4 - C	4/15	9/8	3
Open Poll.	5/4	9/8	1
	Tree 16 above		
Un - 10 - C	4/15	9/9	2
Row 2			
Un - 10 - C	4/12	9/9	6
Open Poll.	5/4	9/9	1
Row 3			
Open Poll.	5/4	9/9	7
Row 5			
Open Poll.	5/4	9/9	1
10 x 10 - S	4/12	9/9	5
Tree 10 - S bag		9/9	1
Row 6			
Tree 10 - S bag		9/9	7
Row 7			
Tree 10 - S bag	~~####~~	9/9	1
10 - Un - S ♂♀	4/12	9/8	6
Row 8			
10 - Un - S ♂♀	4/12	9/8	1
10 x 10 - S	4/12	9/9	1
10 x 4 - P	4/14	9/9	1
10 x 10 - S	4/12	9/9	1
10 x 4 - P	4/12	9/9	1
Open Poll.	5/4	9/9	2
Row 9			
Open Poll.	5/4	9/9	7
Row 10			
Open Poll.	5/4	9/9	4
10 - Un - S ♀♂	4/12	9/9	3

Flat 9

Row #4	Bagged	Collected	No.
Open Poll.	5/4	9/9	7
~~Open Poll~~.			

Flat 41 2/2/56

	Bagged	Collected	No.
Row 1			
10 - Un - S ♂♀	4/12	9/9	6
10 - Un - P ♂♀	4/12	9/9	1
Row 2			
10 - Un - P ♂♀	4/12	9/9	2
10 - Un - S ♂♀	4/12	9/9	2
	Tree 10 above		
8 x 4 - C	4/19	9/8	3
Row 3			
Open Poll.	5/3	9/8	1
8 x 4 - C	4/19	9/8	3
Tree 8		9/8	2
8 x 8 - P	4/12	9/7	1
Row 4			
8 x 8 - P	4/12	9/7	3
Open Poll.	5/3	9/8	4
Row 5			
Self Poll.	5/3	9/9	2
8 x 8 - P	4/19	9/8	1
Open Poll.	5/3	9/8	3
Self Poll.	5/3	9/9	1
Row 6			
Self Poll.	5/3	9/9	3
Self Poll.	5/3	9/9	1
Tree 8		9/9	1
8 x 4 - P ♂♀	4/19	9/8	1
8 x 4 - C	4/19	9/8	1
Row 7			
8 x 4 - C	4/19	9/8	#2
Open Poll.	5/3	8/9	#4
Self	3/5 5/3	9/8	1
Row 8			
Tree 8		9/8	3
Self Poll.	5/3	9/8	1
Open Poll.	5/3	9/8	2
Tree 8		9/8	1

Flat 41 (Cont.)

Rwo 9

Self	5/3		9/8		1
8 - Un - P	4/19		9/8		4
Self	5/3	1 1/2	9/9	1 1/8	2

Row 10

Selfed	5/3	2 7/16 1 9/16	9/9	1 15/16 1 5/16	1
		Tree 8 above			
6 x 10 - P	4/12	2	9/12	1 3/4	6

Flat 69 2/3/56

Row 1

		2 5/16 1 13/16 1 3/8 1 1/2 1 13/16		1 13/16 1 7/16 1 7/16 1 3/16 1 1/16	
Tree 6					5
6 x 10 - C	4/12	1 13/16 1 1/4	9/12	1 7/16 1 1/8	2

Row 2

6 x 10 - P	4/12		9/9		4
6 x 4 - C	4/14		9/12		3

Row 3

		1 11/16 1 1/8		1 3/8 1 5/16	
6 x 10	4/12		9/12		2
6 - self-poll.	4/19		9/12		1
Open Poll.	5/3		9/12		1
6 x 4 - P	4/12		9/12		3

Row 4

		1 7/8 1 1/4		2 1/16 1 3/8	
6 x 4 - P	4/12		9/12		2
Open Poll.	5/3		9/12		5

Row 5

Self Poll.	4/12		9/12		3
6 x 8 - C	4/12		9/12		1
6 x 4 - C	4/12		9/12		1
Open Poll.	5/3		9/12		1
6 x 8 - C	4/14		9/12		1

Row 6

6 x 8 - C	4/14		9/12		6
6 x 4 - P	4/12	1 1/8	9/12	3/4	1

Row 7

6 x 4 - P	4/12		9/12		1

Flat 69 (Cont.)	Bagged		Collected		No.
Row 7 (cont.)					
6 x4 - C	4/14		9/12		5
6 x 8 - P	4/14	3/4	9/12	3/4	1
Row 8		1 3/4		1 3/8	
6 x 4 - C	4/12		9/12		7
Row 10	P10	1 3/8, 1 13/16, 2 3/16, 1 7/8		1 3/16, 1 7/8, 1 7/16, 1 7/16	
S Bag			9/9		1
6 x 8 - C	4/14		9/12		2
6 x 4 - P	4/12		9/12		4

Flat 94 2/6/56 Soil unsterilized

Row 1					
6 x 10	4/12	2 1/2	9/12	2 1/4	2
6 x 10 - C	4/12	2 3/8	9/12	1 1/16	2
6 x 10 - P	4/12		9/12		3
Row 2					
6 x 10 - P	4/12	3 1/8	9/12	2 1/4	3
6 x 4 - S	4/12		9/9		1
6 x 4 - P	4/12		9/12		3
Row 3					
6 x 4 - P	4/12	1 3/16	9/12	1 1/16	1
6 x 8 - C	4/14		9/12		6
Row 4					
Open Poll.	5/3	2	9/12	15/16	1
6 x 10 - P	4/12	1 1/4	9/9	1 1/4	6
Row 5		2 1/2		2 1/4	
Open Poll.	5/3		9/12		3
6 x 10 - C	4/12		9/12		1
6 x 8 - P	4/14		9/12		1
6 x 4 - P	4/12		9/12		1
6 x 10 - P	4/12		9/12		1
Row 6		1 7/8		1 3/16	
6 x 10 - P	4/12		9/12		4
6 x 6 - selfed	4/14	1 1/2	9/12	15/16	3

P9 1 1/2, 1 5/8 | 1 1/16, 1 7/16

Flat 69

Row 9	Bagged	Collected	No.
6 x 4 - C	4/12	9/9	1
6 x 4 - S	4/10	9/9	1
6 x 4 -C	4/10	9/9	4
Un -C	4/12	9/9	1

Flat 94 (Cont.)

	Bagged		Collected		No.
Row 7					
6 x 6 - selfed	4/14	1 13/16, 2 1/4, 7.5	9/12	1 3/4, 1 3/4, 6.6	1
Tree 6					6
Row 8		1 5/8, 2 3/8, 6.9		11/16, 1 13/16, 4.4	
Tree 6					2
6 x 8 - C	4/14		9/12		3
6 x 4 - P	4/12		9/12		2
Row 9		5.0, 3.8, 4.4		3.2, 3.8, 5.7	
6 x 4 - P	4/12		9/12		7
Row 10		3.9, 5.1		3.0, 4.5	
Self Poll.	4/14	2.1	9/12	3.9	3
Open Poll.	5/3	5.8	9/12	5.7	4
	R1 none		none		

Flat 97 2/6/56 Soil unsterilized

	Bagged		Collected		No.
Row 1	R2	4.9, 4.3, 4.9, 2.9, 1.8		3.3, 3.7, 4.7, 3.4, 1.8	
Self Poll.	4/14		9/12		4
6 x 6 - self	4/14		9/12		3
Row 2	R3				
6 x 6 - self	4/14		9/12		5
6 x 10 - P	4/12		9/9		2
Row 3	R4	1.7, 4.6		1.9, 4.1	
6 x 10 - P	4/12		9/9		3
6 x 4 - C	4/12		9/12		4
Row 4	R5	5.1		3.4	
6 x 4 - C	4/12		9/12		7
Row 5					
6 x 4 - C	4/12		9/12		6
6 x 4 - P	4/12		9/9		1
Row 6					
6 x 4 - P	4/12	3.9, 4.5, <1.7	9/9	2.5, 4.6, 4.1	7

Flat 97 (Cont.)

	Bagged		Collected		No.
Row 7		4.7, 5.5, 4.9, 4.8		3.3, 4.6, 3.8, 3.5	
6 x 4 - P	4/12		9/9		5
6 - Un - C	4/12		9/12		2
Row 8		3.9		3.3	
6 - Un - C	4/12		9/12		3
6 x 10 - S ♀ ♂	4/12		9/12		4
Row 9		3.9, 5.8, 4.0, 3.9		2.3, 4.1, 3.0, 3.2	
6 x 4 - C	4/12		9/12		7
Row 10		4.8, 4.4, 4.4, 4.3		4.0, 3.2, 3.9, 4.9	
6 x 4 - C	4/12	R4	9/12	R2	7

R 1. 4.9, 3.4, 4.9, 3.1 — 4.3, 2.1, 3.1, 2.1

Flat Longer, more shallow unsterilized also 2/7/56

	Bagged		Collected		No.
Rows 1-4		4.0, 2.8, 2.9, 3.8, 4.9		3.1, 2.0, 3.4, 3.1, 3.8	
6 x 4 - C	4/12		9/12		7
Row 5		2.4, 5.6, 3.9, 3.3, 3.3, 2.6		2.3, 3.7, 3.7, 3.2, 1.7, 1.8	
6 x 4 - C	4/12		9/12		3
Open Poll.	5/3		9/12		4
Row 6		3.2, 3.7, 4.0, 2.4		2.2, 4.6, 3.8, 2.4	
Open Poll.	5/3		9/12		1
6 x 4 - C	4/10		9/9		1
6 x 4 - C	4/12		9/12		5
Row 7		2.5, 3.7, 3.1, 3.5		2.0, 3.3, 2.6, 3.0	
6 x 4 - C	4/12		9/12		6
6 x 10 - S	4/12		9/12		1
Row 8		2.5, 3.0		2.8, 2.0	
6 x 10 - S	4/12		9/12		7
Row 9		2.4		2.2	
6 x 10 - S	4/12		9/12		1
6 x 10 - P	4/12		9/12		1
6 - Un - C ♂ ♀	4/10		9/12		5

R2: 3.4, 5.2, 6.0, 3.9, 4.0 — 2.4, 3.1, 4.6, 2.7, 3.5

R3: 4.5, 5.1, 4.8, 4.7 — 3.5, 4.8, 2.8, 3.5

Flat — (cont.)

~~Flat 97 (Cont.2)~~

	Bagged		Colleged		No.
Row 10					
6 - Un - C ♂♀	4/19		9/12		7
Flat 85 2/13/56					
Row 1					
6 x 8 - P	4/14		9/12		3
Open Poll.	5/3		9/12		4
Row 2		3.9		2.6	
Open Poll.	5/3		9/12		1
6 x 4 - P ♀♂	4/12		9/12		6
Row 3					
6 x 4 S	4/10		9/9		4
6 x 4 - C	4/12		9/12		3
Row 4		2.6 3.4 2.7 2.7 3.4 3.1		2.1 1.1 2.1 .8 1.0 1.1	
Open Poll.	5/3		9/9		4
6 - Un - C ♀♂	4/12		9/12		3
Row 5		3.7 4.5 4.1		2.2 3.2 2.4	
6 x 4 - C	4/10		9/9		7
Row 6		4.3		3.1	
6 x 4 * C	4/10		9/9		3
6 x 4 - C	4/12		9/12		4
Row 7		3.1 3.7 4.6		3.1 2.7 3.7	
6 x 4 - C	4/12		9/12		5
6 - Un - P ♀♂	4/12		9/12		1
Un - P	4/12		9/12		1
Row 8		4.1 5.0		2.8 2.8	
Un P	4/12		9/12		3
6 x 4 - P (?)	4/		9/9		4
Row 9		4.9 6.8 3.5 3.0		4.0 5.1 3.9 2.9	
6 x 4 - P (?)	4/		9/9		2
6 x 4 - P	4/12		9/12		5

Flat 85 (Cont.)

	Bagged	Collected	No.
Row 10			
Open Poll.	5/3	9/12	7
Flat 60 2/14/56			
Row 1			
Un - S ♂ ♀	4/12	9/12	5
6 x 4 - C	4/14	9/12	2
Row 2			
6 x 4 - C	4/14	9/12	7
Row 3			
Open Poll.	5/4	9/8	5
16 x 4 - P (Tree 6 above)	4/15	9/12	2
Row 4			
16 x 4 - P	4/15	9/12	1
Open Poll.	5/14	9/8	6
Rows 5 - 7			
Open Poll.	5/14	9/8	7
Row 8			
Open Poll.	5/14	9/8	1
16 x 8 - C (Tree 16 above)	4/15	9/8	1
10 - Un - S ♂ ♀	4/12	9/9	4
Open Poll.	5/4	9/9	1
Row 9			
Open Poll.	5/4	9/9	3
10 - Un - P ♂	4/12	9/9	1
10 - Un - S ♀ ♂	4/12	9/9	3
Row 10			
10 - Un - S ♀ ♂	4/12	9/9	4
Open Poll.	5/4	9/9	3

Flat 92 2/15/56

	Bagged		Collected		No.
Row 1		3.8		2.4	
Open Poll.	5/4		9/9		7
Row 2		2.9		1.7	
Tree 10 - S bag			9/9		5
10 x 10 - S	4/12		9/9		2
Row 3					
10 x 10 - S	4/12		9/12		5
10 - Un - S ♂♀	4/12		9/9		2
Row 4		3.5		1.9	
10 - Un - S ♂♀	4/12	4.0	9/9	.9	2
Un - 10 - C	4/12		9/9		5
Row 5		2.2		1.2	
Un - 10 - C	4/12		9/9		4
	Tree 10 above				
Open Poll.	5/3		9/9		3
Row 6		4.7 4.5 2.8		3.0 3.9 1.3	
Open Poll.	5/3		9/9		2
7 x 10 - P	4/12		9/9		1
Open Poll.	5/3		9/7		2
Open Poll.	5/3		9/8		2
Row 7		4.5 3.4 3.5 3.2 9.2		3.6 1.8 1.7 .6 3.2	
Open Poll.	5/3		9/8		5
Open Poll.	5/3		9/7		2
Row 8		4.0 4.5		3.8 4.1	
Open Poll.	5/3		9/7		3
7 x 4 - C	4/12	3.8	9/9	2.6	1
7 x 4 - P	4/12		9/7		2
7 x 4 ⊖ C	4/12		9/7		1
Row 9					
7 x 4 - C	4/12	3.6	9/7	3.3	1
7 x 10 - C	4/12	3.6	9/7		1
Open Poll.	5/3		9/7	1.9	2
7 x 4 - P	4/12		9/8		3

Flat 92 (Cont.)	Bagged	Collected	No.
Row 10			
7 x 4 - C	4/12	9/7	1
Open Poll	4/12	9/9	6
Flat 81 2/16/56			
Row 1			
Open Poll.	5/3	9/8	5
Self Poll.	5/3	9/8	2
Row 2			
Self Poll.	5/3	9/8	4
	Tree 7 above		
8 x 4 - C ♂♀	4/19	9/8	3
Row 3			
8 x 8 - P	4/19	9/8	1
Self	5/3	9/9	2
Open Poll.	5/3	9/9	3
Tree 8	###	9/8	1
Row 4			
Tree 8		9/8	2
Open Poll.	5/3	9/9	1
Self Poll.	?	9/8	1
8 - Un - S ♂♀	4/19 ♂♀	9/9	1
8 - Un - S ♂♀	4/19	9/9	2
Row 5			
8 - Un - P ♂♀	4/19	9/9	4
8 x 8 - P	4/12	9/9	3
Row 6			
Open Poll.	5/3	9/8	3
Blank			1
Open Poll.	5/3	9/8	3
Row 7			
Open Poll.	5/3	9/8	1
Self Poll.	5/3	9/9	3
Tree 8		9/8	3

Flat92 (Cont.)

	Bagged	Collected	No.
Row 8			
Self Poll.	5/3	9/8	6
Open Poll.	5/3	9/8	1
Row 9			
Open Poll.	5/3	9/8	#5
8 x 4 - P	4/19	9/8	2
Row 10			
8 x 4 - C	4/19 2,6	9/9 1,6	6
blank			1

Total 42 seeds collected from unpollinated bags

3/14-17/56

op. - open Poll

Seedling Initial Growth Measurements

Plot 83	Height from root collar to petiole attachment	Leaf length from apex to base	X
R1 1	4.6	4.6	16 x 4
2	5.4	4.4	open Poll -16
3	4.7	4.4	16 x 4
4	6.1	6.1	open Poll -16
5	7.0	7.6	O.P -16
6	6.1	5.7	op. -16
7	4.4	6.5	op. -16
R2 1	5.3	4.6	16 x 4
2	5.34	4.6	16 x 4
3	—	—	
4	4.4	3.9	16 x 8
5	6.4	5.3	16 x 4
6	6.1	4.3	16 x 4
7	4.4	4.3	16 x 14
R3 1	5.4	5.6	op. -16
2	7.0	6.4	op. -16
3	6.4	4.3	16 x 14
4	6.3	5.4	16 x 14
5	5.4	4.4	16 x 14
6	8.9	6.4	16 x 14
7	6.1	6.5	16 x 14
R4 1	7.3	6.5	op. -16
2	5.9	6.5	op. -16
3	6.4	4.7	10 x 10
4	4.4	4.3	10 x 10
5	5.1	4.4	10 x 10
6	7.6	4.4	10 x 10
7	5.7	5.3	op. -10
R5 1	4.4	4.7	op. -10
2	7.5	5.7	op. -10
3	—	—	
4	5.4	5.1	op. -10
5	4.1	3.7	op. -10
6	5.7	5.4	op. -10
7	—	—	

	Height of Seedling	Leaf length	X
R6 1	5.6	5.3	ap -10
2	1.3	3.8	10-Un
3	3.8	3.9	10-Un
4	4.3	3.9	10-Un
5	5.1	3.5	10-Un
6	1.9	2.8	10-Un
7	—	—	—
R7 1	5.4	5.1	10-Un
2	5.1	3.1	10-Un
3	2.4	3.1	10-Un
4	—	—	—
5	—	—	—
6	5.7	6.4	ap -10
7	5.1	5.1	ap. -10
R8 1	4.7	3.8	ap -10
2	5.3	3.4	ap -10
3	6.0	6.0	ap -10
4	5.1	3.0	ap -10
5	3.8	3.3	ap -10
6	—	—	—
7	—	—	—
R9 1	5.6	3.8	ap -10
2	6.7	4.7	ap -10
3	3.9	4.1	ap -10
4	4.4	4.4	ap -10
5	5.7	5.4	ap -10
6	5.1	4.6	ap -10
7	5.4	4.7	ap -10
R10 1	—	—	—
2	4.4	4.9	ap -10
3	4.1	3.8	ap -10
4	—	—	—
5	—	—	—
6	—	—	—
7	3.5	4.4	ap -10

3/14-17/56

Maple Seedling Initial Growth Measurements

Flat 78	petiole attach to root collar Height	apex to base Leaf length	X	Flat	Stem Height	Leaf length	X
R1 1	4.4	4.4	un-10				
2	7.0	4.4	un-10				
3	2.7	3.0	un-10				
4	6.7	4.4	un-10				
5	—	—	—				
6	3.3	4.1	un-10				
7	—	—	—				
R2 1	—	—	—				
2	4.4	4.1	un-10				
3	4.4	3.3	ap-10				
4	—	—	—				
5	3.8	2.7	un-10				
6	—	—	—				
7	—	—	—				
R3 1	3.8	3.8	10-un				
2	4.4	4.1	10-un				
3	4.7	3.9	10-un				
4	2.8	3.9	ap-10				
5	3.0	2.5	ap-10				
6	5.7	5.3	ap-10				
7	—	—	—				
R4 1	7.0	6.0	ap-10				
2	7.0	6.4	ap-10				
3	6.7	5.1	ap-10				
4	4.4	4.9	ap-10				
5	7.0	5.1	ap-10				
6	2.2	3.8	ap-10				
7	2.8	4.30	ap-10				
R5 1	7.2	4.4	ap-10				
2	5.7	5.4	ap-10				
3	3.5	4.6	ap-10				
4	5.1	5.3	ap-10				
5	5.1	4.3	ap-10				
6	5.4	5.3	ap-10				
7	5.7	5.3	ap-10				

Flat 74	Height of stem	Leaf Length	X	Flat	Stem Height	Leaf Length	X
R6							
1	4.1	2.8	10 s bag				
2	4.9	5.4	10 s bag				
3	3.1	3.8	10 s. bag				
4	—	—	—				
5	3.7	5.1	10 s bag				
6	3.1	2.2	10-un				
7	—	—	—				
R7							
1	6.4	1.6	10-un				
2	5.1	3.9	10x10				
3	7.6	5.4	10 x 7				
4	3.8	5.6	7x4				
5	7.0	5.1	7 x 4				
6	5.7	4.9	7x4				
7	7.8	3.5	7x4				
R8							
1	7.8	3.5	7x4				
2	6.4	6.4	7x10				
3	6.7	6.1	7x10				
4	5.3	5.1	ap -7				
5	3.7	4.1	ap - 7				
6	6.4	5.1	ap - 7				
7	5.1	5.7	ap - 7				
R9							
1	7.2+	6.4	ap - 7				
2	5.1	4.9	ap - 7				
3	4.7	3.8	ap - 7				
4	4.7	4.7	ap - 7				
5	—	—	—				
6	6.0	2.8	ap - 7				
7	4.1	5.4	ap - 7				
R10							
1	—	—	—				
2	3.7	5.1	ap - 7				
3	4.7	4.4	ap - 7				
4	2.8	4.4	ap - 7				
5	3.5	6.5	ap - 7				
6	8.1	6.3	7x4				
7	—	—	—				

Flat 49	Stem Height	Leaf Length	X
R1 1	7.8	6.1	7x4
2	7.6	9.6	7x10
3	7.3	5.7	ap-7
4	6.1	5.9	ap-7
5	5.3	6.7	ap-7
6	6.5	6.1	ap-7
7	5.4	5.7	ap-7
R2 1	6.0	4.7	7x4
2	6.7	6.1	7x4
3	—	—	—
4	7.0	6.1	ap-7
5	6.4	6.4	ap-7
6	4.7	5.6	ap-7
7	5.6	5.4	6x6-self
R3 1	3.1	3.1	6x6-self
2	—	—	—
3	2.4	4.1	6x6-self
4	5.1	5.1	6x6-self
5	5.1	3.9	6-un
6	4.9	4.1	6-un
7	3.3	2.5	6-un
R4 1	—	—	—
2	3.8	3.8	6x4
3	4.4	3.5	6x4
4	—	—	—
5	4.1	3.8	un-6
6	—	—	—
7	5.1	5.1	6x4
R5 1	3.1	3.8	6x4
2	4.9	4.7	6x4
3	4.1	2.8	6x4
4	5.4	5.7	6x4
5	4.9	4.4	6x4
6	6.1	3.8	6x4
7	—	—	—

Slat 49	Stem Height	Leaf Length	X
R6 1	—	—	—
2	3.7	3.5	6 x 4
3	—	—	—
4	3.1	3.5	6-lens
5	5.1	3.8	6 x 4
6	5.6	4.6	6 x 4
7	6.3	5.1	6 x 4
R7 1	4.4	3.9	6 x 4
2	—	—	—
3	3.5	4.1	6 x 4
4	4.4	4.11	6 x 4
5	6.4	5.3	6 x 4
6	5.4	4.9	6 x 4
7	3.3	2.5	6 x 4
R8 1	4.6	4.7	6 x 4
2	—	—	—
3	1.9	2.7	6 x 4
4	6.4	5.7	6 x 4
5	3.9	3.8	6 x 4
6	3.7	2.7	6 x 4
7	4.7	3.5	6 x 4
R9 1	3.5	2.7	10 x 6?
2	3.8	3.9	10 x 6? 6 x 10
3	3.8	3.9	10 x 6?
4	5.4	5.4	6-len
5	4.7	3.8	6-len
6	—	—	—
7	6.8	7.0	6-len
R10 1	3.5	3.8	ape. 6
2	5.7	4.45	ape-6
3	6.4	6.5	ape-6
4	5.7	4.1	ape-6
5	3.3	3.8	6-lens
6	3.9	4.7	ape-6
7	6.7	4.4	ape.-6

Flat 48	Stem Height	Leaf Length	X
R1			
1	—	—	
2	5.1	4.3	6 x 4
3	5.7	5.3	6 x 4
4	6.4	6.3	6 x 10
5	5.1	5.9	6 x 10
6	3.0	2.2	6 x 4
7	—	—	
R2			
1	—	—	
2	4.4	4.3	6 x 4
3	—	—	
4	5.1	6.0	6 x 10
5	5.3	6.0	6 x 10
6	5.1	5.6	6 x 10
7	—	—	
R3			
1	5.4	5.4	6 x 4
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	5.7	4.3	6 x 4
7	—	—	
R4			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	5.4	6.7	6 x 10
6	—	—	
7	5.1	3.8	6 x 8
R5			
1	—	—	
2	7.3	5.4	6 x 4
3	5.4	5.4	6 x 4
4	5.4	5.4	6 x 4
5	5.7	6.3	6 x 4
6	5.7	7.3	6 x 4
7	6.0	5.3	6 x 4

Flat 44	Stem Height	Leaf Length	X
R6			
1	—	—	
2	5.7	5.3	Free 6
3	5.1	4.4	Free 6
4	5.3	5.1	Free 6
5	—	—	
6	5.7	5.9	6 x 4
7	5.4	7.2	6 x 4
R7			
1	—	—	
2	—	—	
3	2.5	2.4	6 x 10
4	4.4	3.8	6 x 10
5	3.7	4.4	6 x 4
6	4.1	4.4	6 x 8
7	4.9	4.7	ap -6
R8			
1	—	—	
2	—	—	
3	—	—	
4	4.4	3.9	6 x 4
5	—	—	
6	4.7	4.9	6 x 4
7	—	—	
R9			
1	—	—	
2	4.7	4.3	6 x 4
3	—	—	
4	—	—	
5	2.8	2.7	4 x 4
6	3.3	4.7	4 x 4
7	—	—	
R10			
1	—	—	
2	2.7	2.5	ap -8
3	2.8	3.0	ap -8
4	—	—	
5	—	—	
6	—	—	
7	—	—	

Flat 64	Stem Height	Leaf Length	X
R1 1	–	–	–
2	–	–	–
3	–	–	–
4	–	–	–
5	5.2	4.4	6 x 4
6	8.9	3.0	6 x 4
7	7.0	3.1	6 x 4
R2 1	–	–	–
2	–	–	–
3	–	–	–
4	5.9	4.4	6 x 4
5	5.6	5.3	6 x 4
6	5.9	4.3	6 x 4
7	6.3	4.7	6 x 4
R3 1	–	–	–
2	–	–	–
3	–	–	–
4	–	–	–
5	–	–	–
6	5.4	3.9	6 x 4
7	6.7	4.6	6 x 4
R4 1	–	–	–
2	–	–	–
3	–	–	–
4	5.7	4.7	6 x 4
5	3.3	3.9	6 x 4
6	6.7	5.1	6 x 4
7	–	–	–
R5 1	6.4	5.7	6 x 4
2	–	–	–
3	–	–	–
4	–	–	–
5	3.8	3.1	6 x 10
6	–	–	–
7	–	–	–

Flat 64	Flame Height	Leaf Length	X
R6			
1	4.4	4.1	6 x 10
2	–	–	
3	–	–	
4	–	–	–
5	4.1	3.7	6 x 10
6	–	–	
7	–	–	
R7			
1	–	–	
2	–	–	
3	–	–	
4	3.3	4.3	6 x 4
5	–	–	
6	3.8	4.1	6-lvs
7	–	–	
R8			
1	3.9	3.7	ap-6
2	–	–	
3	–	–	
4	–	–	
5	–	–	
6	5.7	6.5	ap-6
7	5.9	5.3	ap.-6
R9			
1	–	–	
2	–	–	
3	–	–	
4	3.8	4.4	6 x 4
5	5.7	7.2	6 x 4
6	4.7	4.30	6 x 4
7	–	–	
R10			
1	6.3	6.0	ap -6
2	4.7	4.4	ap -6
3	6.0	5.6	ap. -6
4	–	–	blank
5	–	–	blank
6	–	–	blank
7	–	–	blank

Flat 24	Stem Height	Leaf Length	X
R1 1	9.5	6.0	ap - 7
2	6.4	5.4	ap - 7
3	9.5	5.3	7x4
4	6.5	5.3	7x4
5	7.3	5.6	ap - 7
6	3.9	4.6	ap - 7
7	—	—	
R2 1	—	—	
2	4.9	4.9	ap - 7
3	6.7	6.0	ap - 7
4	4.1	4.3	ap - 7
5	5.3	5.4	ap - 7
6	6.0	4.9	ap - 7
7	—	—	
R3 1	—	—	
2	3.1	3.6	4x4
3	4.3	3.7	7x4
4	3.4	3.8	7x4
5	6.4	4.6	7x4
6	5.3	4.7	7x4
7	4.6	3.9	7x4
R4 1	—	—	
2	—	—	
3	2.4	2.5	Self - 8
4	—	—	
5	3.9	3.5	Lue 8
6	—	—	
7	—	—	
R5 1	—	—	
2	—	—	
3	2.8	2.2	4x4
4	—	—	
5	—	—	
6	2.5	3.5	ap - 8
7	—	—	

Flat 24	Stem Height	Leaf Length	X
R6			
1	—	—	
2	2.8	2.4	8-self
3	—	—	
4	2.8	2.1	8-self
5	—	—	
6	—	—	
7	—	—	
R7			
1	2.5	2.1	free 8
2	—	—	
3	—	—	
4	3.9	2.7	4-un
5	3.1	4.7	8-un
6	—	—	
7	—	—	
R8			
1	3.8	4.6	free 8
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	3.9	3.7	free 8
R9			
1	4.1	3.9	4×4
2	2.2	2.4	4p-8
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	—	—	
R10			
1	4.3	4.7	8×4
2	—	—	
3	—	—	
4	—	—	
5	3.8	3.8	8×8-self
6	4.1	4.1	8×8-self
7	4.7	3.7	8×8-self

Flat 75	Stem Height	Leaf Length	X
R1			
1	—	—	
2	6.3	4.1	ap -7
3	6.4	5.1	ap -7
4	6.7	5.1	ap -7
5	6.5	4.9	ap -7
6	5.6	4.3	ap -7
7	6.0	4.9	ap -7
R2			
1	—	—	
2	5.7	5.6	7x4
3	7.3	5.6	ap -7
4	6.4	6.4	ap -7
5	6.4	6.4	ap -7
6	6.7	5.7	ap -7
7	5.3	5.9	ap -7
R3			
1	—	—	
2	5.7	4.4	ap -7
3	6.3	5.3	ap -7
4	4.9	5.3	ap -7
5	7.0	6.3	ap -7
6	5.6	6.3	7x10
7	5.4	5.3	7x10
R4			
1	—	—	
2	6.4	4.6	7x4
3	3.1	2.1	ap -7
4	3.0	2.7	ap -7
5	5.3	5.6	ap -7
6	—	—	
7	—	—	
R5			
1	—	—	
2	5.7	4.4	ap -16
3	4.3	3.7	ap -16
4	3.8	4.1	ap -16
5	7.2	4.6	ap -16
6	5.1	3.7	ap -16
7	—	—	ap -16

Flat 75	Stem Height	Leaf Length	X
R6			
1	—	—	
2	4.9	4.3	ap -16
3	4.4	3.5	ap -16
4	4.4	4.3	ap -16
5	3.0	4.6	ap -16
6	—	—	
7	—	—	
R7			
1	4.9	5.1	ap -16
2	2.5	4.3	ap -16
3	2.7	4.7	ap -16
4	4.3	3.0	ap -16
5	5.1	4.4	ap -16
6	7.8	5.6	ap -16
7	—	—	
R8			
1	2.5	2.4	ap -16
2	5.3	4.4	ap -16
3	—	—	
4	5.4	6.3	ap -16
5	5.3	4.4	ap -16
6	3.9	3.0	ap -16
7	4.7	3.1	ap -16
R9			
1	—	—	
2	6.7	5.6	ap -16
3	5.9	3.9	16 x 4
4	3.8	3.8	16 x 8
5	7.0	4.7	16 x 4
6	—	—	
7	—	—	
R10			
1	—	—	
2	—	—	
3	5.7	4.4	16 x 4
4	2.5	2.5	16 x 4
5	6.0	4.6	ap -16
6	—	—	
7	—	—	

Flat 9	Stem Height	Leaf length	X
R1 1	—	—	
2	—	—	
3	—	—	
4	5.6	4.4	16×4
5	4.9	4.4	ap-16
6	—	—	
7	5.1	4.1	un-10
R2 1	—	—	
2	—	—	
3	2.7	5.1	un-10
4	4.4	2.8	un-10
5	—	—	
6	—	—	
7	3.5	2.1	ap-10
R3 1	4.7	1.5	ap-10
2	3.8	3.3	ap-10
3	—	—	ap-10
4	5.1	3.3	ap-10
5	3.7	4.1	ap-10
6	—	—	
7	3.1	3.3	ap-10
R4 1	3.8	3.7	ap-10
2	3.4	3.8	ap-10
3	1.9	2.7	ap-10
4	3.0	2.7	ap-10
5	2.5	2.2	ap-10
6	—	—	
7	—	—	
R5 1	1.9	2.2	ap-10
2	—	—	
3	—	—	
4	3.1	2.4	10×10
5	2.5	3.0	10×10
6	1.9	2.7	10×10
7	—	—	

Flat 9	Stem Height	Leaf Length	X
R6			
1	3.5	3.7	10-S bag
2	4.1	2.7	10-S bag
3	2.8	2.8	10-S bag
4	3.1	3.7	10-S bag
5	—	—	
6	2.8	3.5	10-S bag
7	3.1	2.5	10-S bag
[illegible]			
1	—	—	
2	5.1	4.1	10-len
3	3.5	2.8	10-len
4	—	—	
5	—	—	
6	2.5	3.1	10-len
7	—	—	
R4			
1	~~[illegible]~~	—	
2	5.7	4.7	10×10
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	3.8	3.3	ap-10
R7			
1	5.1	3.9	ap-10
2	4.6	3.5	ap-10
3	—	—	
4	7.0	4.4	ap-10
5	—	—	
6	—	—	
7	2.8	3.7	ap-10
R10			
1	—	—	
2	3.9	2.8	ap-10
3	5.4	3.9	ap-10
4	—	—	
5	—	—	
6	—	—	
7	—	—	

Flat 41	Stem Height	Leaf Length	X
R1			
1	—	—	
2	3.7	2.5	10-un
3	—	—	
4	—	—	
5	3.7	4.1	10-un
6	—	—	
7	—	—	
R2			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	—	—	
R3			
1	—	—	
2	2.8	2.4	Lu 6
3	—	—	
4	—	—	
5	2.5	1.9	4 x 4
6	3.1	3.3	4 x 4
7	—	—	
R4			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	—	—	
R5			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	3.7	2.8	ap - 8
6	3.3	3.3	ap - 8
7	—	—	

Flat 41	Stem Height	Leaf Length	×
R6 1	3.3	3.0	self-4
2	—	—	
3	—	—	
4	3.5	3.5	4-self
5	—	—	
6	3.1	2.7	4×4
7	—	—	
R7 1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	3.8	3.7	ap-8
6	2.8	3.9	ap-8
7	—	—	
R8 1	—	—	
2	—	—	
3	—	—	
4	3.5	3.9	8-self
5	3.7	3.6	ap-8
6	3.8	3.5	ap-8
7	1.8	1.2	fm 8
R9 1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	3.8	2.8	8-self
R10 1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	6.3	4.9	6×10
6	3.9	3.5	6×10
7	5.1	4.45	6×10

Hort 69	Stem weight	Leaf length	X
R1			
1	5.9	4.9	free 6
2	4.6	3.7	free 6
3	—	—	
4	3.5	3.7	free 6
5	3.5	3.0	free 6
6	4.6	4.3	6x10
7	—	—	
R2			
1	—	—	
2	—	—	
3	4.6	3.9	6x10
4	—	—	
5	2.8	2.8	6x4
6	—	—	
7	—	—	
R3			
1	—	—	
2	4.3	3.5	6x10
3	—	—	
4	2.8	3.3	op. -6
5	—	—	
6	—	—	
7	—	—	
R4			
1	4.3	5.3	6x4
2	—	—	
3	—	—	
4	3.1	3.5	op -6
5	—	—	
6	—	—	
7	—	—	
R5			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	—	—	

Plot 69	Stem Height	Leaf Length	X
R6			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	2.8	1.9	6 x 4
R7			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	2.2	2.2	6 x 8
R8			
1	—	—	
2	—	—	
3	—	—	
4	4.4	3.5	6 x 4
5	—	—	
6	—	—	
7	—	—	
R9			
1	3.8	2.7	6 x 4
2	4.7	3.7	6 x 4
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	—	—	
R10			
1	3.8	3.0	5 lag 6
2	4.6	4.7	6 x 8
3	5.6	3.7	6 x 8
4	—	—	
5	—	—	
6	4.7	3.0	6 x 4
7	—	—	

Flat 94	Stem Height	Leaf Length	X
R1			
1	—	—	
2	6.4	5.7	6x10
3	—	—	
4	6.0	4.9	6x10
5	—	—	
6	—	—	
7	—	—	
R2			
1	—	—	
2	—	—	
3	—	—	
4	7.8	5.7	6x4
5	—	—	
6	—	—	
7	—	—	
R3			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	3.0	4.3	6x8
6	—	—	
7	—	—	
R4			
1	5.1	2.4	op-6
2	—	—	
3	3.1	3.1	6x10
4	—	—	
5	—	—	
6	—	—	
7	—	—	
R5			
1	5.7	5.4	op-6
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	—	—	

Plot 94	Stems Height	Leaf length	^
R6 1	—	—	
2	4.7	4.6	6×10
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	3.8	2.4	6×6-self
R7 1	—	—	
2	4.6	3.5	6×6-self
3	—	—	
4	—	—	
5	—	—	
6	3.7	4.4	Lue 6
7	1.5	6.6	Lue 6
R8 1	4.1	1.8	Lue 6
2	—	—	
3	—	—	
4	6.0	4.6	6×4
5	—	—	
6	—	—	
7	6.9	4.4	6×4
R9 1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	5.0	3.2	6×4
6	3.8	3.4	6×4
7	4.8	5.7	6×4
R10 1	—	—	
2	3.9	3.0	6-self
3	—	—	
4	5.1	4.5	op-6
5	—	—	
6	2.1	3.9	op-6
7	5.8	5.7	op-6

Flat 97	Stem height	Leaf length	X
R1 1	–	–	
2	–	–	
3	–	–	
4	–	–	
5	–	–	
6	–	–	
7	–	–	
R2 1	–	–	
2	4.9	3.3	6x6-self
3	4.3	3.7	6x6-self
4	–	–	
5	4.9	4.7	6x6-self
6	2.9	3.4	6x10
7	1.8	1.8	6x10
R3 1	–	–	
2	–	–	
3	–	–	
4	–	–	
5	–	–	
6	–	–	
7	–	–	
R4 1	–	–	
2	1.7	1.9	6x4
3	–	–	
4	–	–	
5	–	–	
6	4.0	4.1	6x4
7	–	–	
R5 1	–	–	
2	–	–	
3	–	–	
4	–	–	
5	–	–	
6	–	–	
7	5.1	3.4	6x4

Flat 97	Stem Height	Leaf Length	X
R6			
1	—	—	
2	—	—	
3	3.9	2.5	6×4
4	—	—	
5	4.5	4.6	6×4
6	4.7	4.1	6×4
7	—	—	
R7			
1	4.7	5.3	6×4
2	5.5	4.6	6×4
3	—	—	
4	4.9	3.8	6×4
5	4.8	3.5	6×4
6	—	—	
7	—	—	
R8			
1	3.9	3.3	6-low
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	—	—	
R9			
1	3.9	2.3	6×4
2	—	—	
3	—	—	
4	5.8	4.1	6×4
5	4.0	3.0	6×4
6	—	—	
7	3.9	3.4	6×4
R10			
1	4.4	4.0	6×4
2	—	—	
3	—	—	
4	4.4	3.2	6×4
5	4.4	3.9	6×4
6	—	—	
7	4.3	4.8	6×4

Plant —	Stem Height	Leaf Length	X
R1 1	—	—	
2	—	—	
3	4.8	4.3	6x4
4	3.8	2.1	6x4
5	4.9	3.1	6x4
6	3.1	2.2	6x4
7	—	—	
R2 1	—	—	
2	3.4	2.1	6x4
3	5.2	3.1	6x4
4	6.0	4.6	6x4
5	3.9	2.7	6x4
6	4.0	3.5	6x4
7	—	—	
R3 1	—	—	
2	—	—	
3	—	—	
4	4.5	3.5	6x4
5	5.1	4.8	6x4
6	4.8	2.8	6x4
7	4.1	3.5	6x4
R4 1	—	—	
2	4.0	3.1	6x4
3	2.8	2.0	6x4
4	2.9	3.6	6x4
5	3.8	3.1	6x4
6	4.9	3.8	6x4
7	—	—	
R5 1	2.4	2.3	6x4
2	3.6	3.7	6x4
3	3.9	3.7	6x4
4	—	—	
5	3.3	3.3	up – 6
6	3.3	1.7	up – 6
7	2.6	1.8	up – 6

Flat —	Stem Height	Leaf Length	— X
R6			
1	3.2	2.2	op — 6
2	3.7	4.6	6x4
3	4.0	3.8	6x4
4	—	—	
5	—	—	
6	2.4	2.4	6x4
7	—	—	
R7			
1	2.5	2.0	6x4
2	—	—	
3	—	—	
4	3.7	3.3	6x4
5	3.1	2.6	6x4
6	3.5	3.0	6x4
7	—	—	
R8			
1	—	—	
2	2.5	2.6	6x10
3	—	—	
4	3.0	2.0	6x10
5	—	—	
6	—	—	
7	—	—	
R9			
1	—	—	
2	—	—	
3	—	—	
4	2.8	2.2	6-lin
5	—	—	
6	—	—	
7	—	—	
R10			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	—	—	

Flat 85	Stem Height	Leaf Length	+
R1			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	—	—	
R2			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	3.9	2.6	6 × 4
6	—	—	
7	—	—	
R3			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	—	—	
R4			
1	2.6	2.1	ap - 6
2	3.4	1.1	ap - 6
3	3.7	2.1	ap - 6
4	2.7	.8	ap - 6
5	3.4	1.0	6 - lm
6	3.1	1.1	6 - lm
7	—	—	
R5			
1	—	—	
2	3.7	2.2	6 × 4
3	—	—	
4	4.5	3.2	6 × 4
5	4.1	2.4	6 × 4
6	—	—	
7	—	—	

Plot 65	Stem Height	Leaf Length	X
R6			
1	4.3	3.1	6x4
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	—	—	
R7			
1	3.1	3.1	6x4
2	—	—	
3	3.9	2.7	6x4
4	4.6	3.9	6x4
5	—	—	
6	—	—	
7	—	—	
R8			
1	—	—	
2	—	—	
3	—	—	
4	4.1	3.8	6x4
5	5.0	2.8	6x4
6	—	—	
7	—	—	
R9			
1	4.9	4.0	6x4
2	6.8	5.1	6x4
3	3.5	3.8	6x4
4	3.0	2.9	6x4
5	—	—	
6	—	—	
7	—	—	
R10			
1	—	—	
2	—	—	
3	—	—	
4	4.5	4.7	ap – 6
5	2.1	1.1	op – 6
6	—	—	
7	—	—	

Flat 60	Stem Height	Leaf Length	X
R1 1	—	—	
2	4.0	2.2	lin - 6
3	4.0	3.1	lin - 6
4	3.6	3.6	lin - 6
5	4.4	2.9	lin - 6
6	5.8	2.7	6 x 4
7	—	—	
R2 1	—	—	
2	—	—	
3	4.8	3.0	6 x 4
4	—	—	
5	—	—	
6	—	—	
7	—	—	
R3 1	2.8	3.1	ap - 6
2	5.5	4.2	ap - 6
3	4.4	3.0	ap - 6
4	5.6	5.1	ap - 6
5	4.4	2.8	ap - 6
6	5.8	5.1	16 x 4
7	4.2	4.3	16 x 4
R4 1	—	—	
2	4.3	3.5	ap - 16
3	4.3	3.7	ap - 16
4	—	—	
5	—	—	
6	4.7	3.2	ap - 16
7	2.6	1.9	ap - 16
R5 1	5.0	3.0	ap - 16
2	—	—	
3	3.1	2.8	ap - 16
4	4.9	3.4	ap - 16
5	3.3	3.1	ap - 16
6	4.6	3.2	ap - 16
7	4.8	3.2	ap - 16

Flat 60	Stem Height	Leaf Length	X
R6			
1	4.4	2.9	ap-16
2	3.6	2.9	ap-16
3	5.4	3.4	ap-16
4	4.2	4.1	ap-16
5	4.0	3.9	ap-16
6	—	—	
7	—	—	
R7			
1	4.4	3.9	ap-16
2	4.6	3.0	ap-16
3	4.4	4.0	ap-16
4	3.3	1.9	ap-16
5	—	—	
6	3.1	1.1	ap-16
7	—	—	
R8			
1	4.3	3.2	ap-16
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	3.3	4.7	ap-10
R9			
1	—	—	
2	—	—	
3	3.4	1.8	ap-10
4	—	—	
5	7.0	3.7	10-lm
6	—	—	
7	—	—	
R10			
1	4.5	3.0	10-lm
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	—	—	

Hag 92	Stem Height	Leaf Length	X
R1			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	3.8	2.4	ap-10
6	—	—	
7	—	—	
R2			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	2.9	1.7	10×10-self
7	—	—	
R3			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	—	—	
R4			
1	—	—	
2	3.5	1.9	10-un
3	—	—	
4	—	—	
5	—	—	
6	4.0	.9	un-10
7	—	—	
R5			
1	—	—	
2	2.2	1.2	ap-10
3	—	—	
4	—	—	
5	—	—	
6	—	—	
7	—	—	

Plat No.	Stem Height	Leaf Length	X
R6			
1	4.7	3.0	ap - 7
2	4.5	3.9	ap - 7
3	2.4	1.3	7 X 10
4	—	—	
5	—	—	
6	—	—	
7	—	—	
R7			
1	4.5	3.0	ap - 7
2	3.4	3.9	ap - 7
3	3.5	1.7	ap - 7
4	3.2	1.6	ap - 7
5	3.2	3.2	ap - 7
6	—	—	
7	—	—	
R8			
1	—	—	
2	—	—	
3	4.0	3.8	ap - 7
4	4.5	4.1	7 x 4
5	—	—	
6	3.8	2.6	7 x 4
7	—	—	
R9			
1	—	—	
2	—	—	
3	—	—	
4	—	—	
5	3.6	3.3	7 x 4
6	—	—	
7	3.6	1.9	7 x 4
R10			
1	—	—	
2	3.2	1.9	ap - 7
3	4.4	3.2	ap - 7
4	4.4	1.6	ap - 7
5	3.3	.9	ap - 7
6	2.8	1.1	ap - 7
7	—	—	

Plat 81	Stem Height	Leaf Length	X
	—	—	
	—	—	
	—	—	
4	—	—	
5	—	—	
6	—	—	
7	1,5	1,1	7x7-self
	—	—	
	—	—	
3	3,1	1,1	7x7-self
	—	—	
5	2,5	1,7	8x4
	2,4	1,9	8x4
	—	—	
	—	—	
	—	—	
	1,9	1,5	8-self
	1,5	1,7	8-self
	—	—	
	—	—	
	—	—	
	—	—1	
	2,4	1,1	free 8
	3,9	3,0	op - 8
	—	—	
	2,3	1,96	8-un
	2,4	.6	8-un
	—	—	
	—	—	
	—	—	
	—	—	
	—	—	
	—	—	
	—	—	

50
25 trees from
unpollinated bags

Shoot 8.1	Stem Height	Leaf length	x
4	3.0	2.2	8 seg
6	2.6	1.6	8 x 4

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